MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 36 APRIL, 1930 Number 8

PRINCIPAL ARTICLES IN THIS NUMBER

Appearance a Vital Factor in Machine Design—*By J. F. Lincoln* 585
Methods of Measuring Tapered Bores—*By William S. Rowell* 589
Inexpensive Fixtures for Running-in New Tools—*By Arthur Aldrich* 594
The Problem of Designing for Production—*By E. P. Blanchard* 595
Ingenious Mechanical Movements 597
Bonus for Beginning Work on Time—*By Elton Sterrett* 601
Current Editorial Comment 602
Why are Obsolete Machines Used?—An Accurate Cost System Promotes Stability in the Industry—New Ideas for Machine Designers—Smooth Finish of Flutes in Tools
A Scientific Basis for Business Forecasts—*By Alvan T. Simonds* 603
Modern Management in the Jobbing Shop—*By Arthur Mumper* 606
Data for Designing Sheet-aluminum Parts—*By K. George Selander* 608
Rolling Grooves in Aluminum Pistons for Airplane Engines—*By H. T. Laffin* 611
Four Methods of Applying Overhead Cost—*By Louis G. Goetz* 612
Building the Gypsy-Moth Plane in America—*By Freeman C. Duston* 617
Lubricating Tapered Roller Bearings—*By H. L. Kauffman* 621
New England Shops Install Modern Equipment—*By Albert R. Stedfast* 623
What is Ahead in Machine Tool Exports?—*By W. H. Rastall* 634
The British Metal-working Industries 639

DEPARTMENTS

What MACHINERY'S Readers Think 592
Notes and Comment on Engineering Topics 600
Letters on Practical Subjects 625
Shop and Drafting-room Kinks 631
Questions and Answers 632
New Shop Equipment 641

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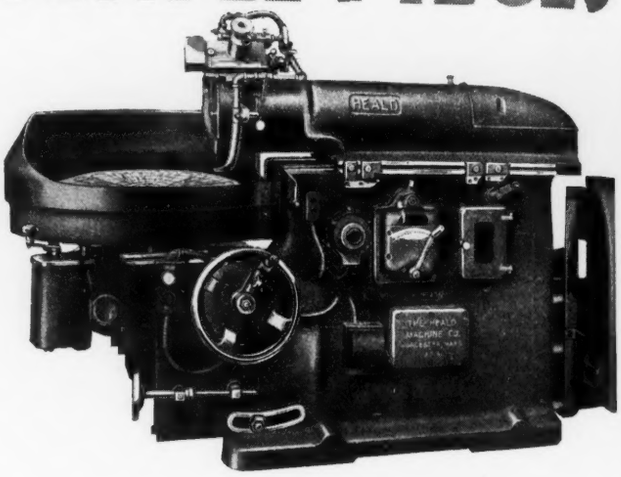

Fig. 1

Fig. 2

Fig. 3

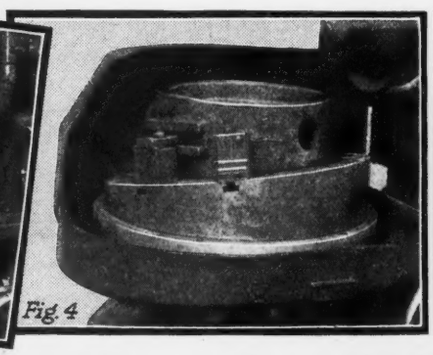

Fig. 4

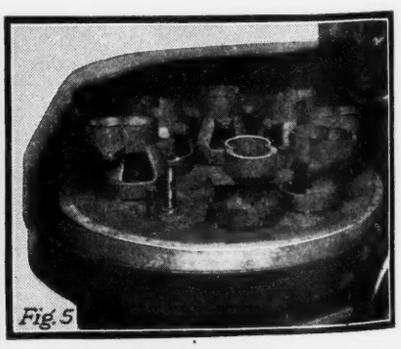

Fig. 5

THE powerful hydraulic electrically driven Style No. 25A Surface Grinder with its large capacity of 30" diameter can be arranged with a variety of holding fixtures that will adapt it to nearly every type of work.

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HEALD

MACHINERY

Volume 36 NEW YORK, APRIL, 1930 Number 8

Appearance a Vital Factor in Machine Design

The Influence of the Electric Arc Welding Process on the Design of Machinery

By J. F. LINCOLN, President, The Lincoln Electric Co., Cleveland, Ohio

PERFORMANCE is probably the most important consideration in the purchase of modern machinery, but the manufacturer who assumes that appearance can be neglected is making a serious error. In the design of a new model or a new machine, the engineer must consider the various materials and methods available, and also the attitude of prospective purchasers toward these features. Thus, although he may not realize it, the designer is dealing with the influence of style while he strives for the highest possible mechanical efficiency and sound construction.

It is essential for the successful merchandising of machinery, in these days of keen competition, that machines should not only be good mechanically, but, that they should have the appearance of being well built. A machine may be exceptionally efficient, but if it looks as though it were built by slip-shod methods, it will suffer a serious sales handicap. In other words, it is natural to associate the idea of efficiency with that of neat and durable appearance. The reverse is also true.

Some industries are now capitalizing on their realization of the importance of appearance in its relation to sound economical construction and high mechanical efficiency. The most notable example is the automotive industry. Machinery manufacturers are now also beginning to take cognizance of this important factor in design. Designers and engineers in the machinery industry are bending their efforts toward attaining the extreme simplicity and grace of modern art in their designs.

From time immemorial, cast construction has been the only means of making the designer's ideas workable and of

J. F. Lincoln

James F. Lincoln was born in Painesville, Ohio. After graduating from the Painesville High School, he attended the Ohio State University from 1902 to 1906. He became a salesman with the Lincoln Electric Co. in 1907, was elected vice-president in 1909, general manager in 1912, and president in 1929. An honorary degree of electrical engineer was conferred upon him in 1926 by the Ohio State University. Mr. Lincoln has taken out a number of patents and has been very active in the development of arc welding equipment, especially of the automatic type. He has also been active in furthering the application of arc welding, and is one of the best known men in the country in this field of engineering work. As early as 1915 he began to advocate the use of arc welded steel to replace castings. The Lincoln Electric Co. produced the first welded structural steel induction motor and the first all-steel arc welder. He is the author of many technical papers on all phases of arc welding. Mr. Lincoln's interests are broad. He has been vice-president and director of the Cleveland Board of Commerce and a member of the Board of Managers of the American Institute of Electrical Engineers. He is also a past-president of the Alumni Association of the Ohio State University.

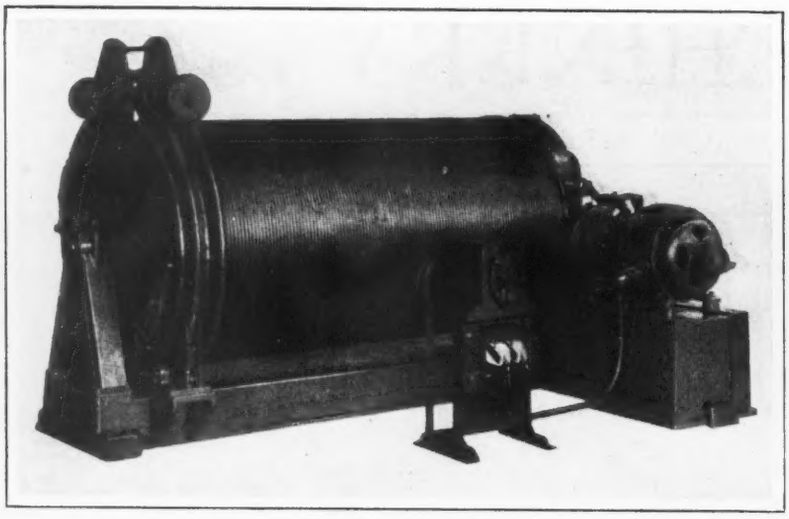


Fig. 1. Elevator Hoist Provided with a Cast Base

securing pleasing appearance. This is no longer the case, and this fact is appreciated by progressive industrial executives, because the costs of cast construction often mount exceptionally high, and design features must frequently be sacrificed on account of the limitations placed upon castings by the method of producing them. Many castings already have been replaced by arc-welded steel construction. Because of the simplicity of design and the flexibility of construction possible with arc-welded parts, this process is playing an important part in the development of new conceptions as to appearance in machinery. Economy in manufacture is also an important item which this modern construction offers to the machine industry.

Typical Examples of Designs in which Welded Construction is Used

The elevator hoist bases in Figs. 1 and 2 illustrate the good appearance obtainable and the saving effected by arc-welded steel construction. Fig. 1 shows the original cast-iron base, and Fig. 2 its arc-welded successor. These bases were constructed by the General Elevator Co., Baltimore, Md. The arc-welded base, replacing the one of cast construction, was fabricated at a saving of 64.5 per cent of the cost of the original base.

A pedestal-type base for a production cutting-off machine made by the Oster Mfg. Co., Cleveland, Ohio, is shown to the right in the heading illustration; this is an excellent example of the good appearance attainable with arc-welded construction. The graceful lines of the cast base formerly used, as shown to the left, are practically duplicated in the modern arc-welded steel base. The arc-welded base weighs only 825 pounds. Its predecessor of cast construction weighed 1150 pounds, or almost 40 per cent more than the base of modern design; yet the arc-welded base, constructed of nine pieces of No. 7 gage sheet steel and two pieces of flat bar stock, is stronger and more rigid than the cast construction.

Evolution in Machine Design

In discussing the changes in appearance of machines, Dr. W. Kummer, noted engineer of Zurich, Switzerland, says: "In the early stages of development, the working mechanisms of machines were exposed, in so far as this was possible, later disappearing more and more inside of closed housings. This transition from the unclad to the clad is based first on technical reasons. It was necessary, as long as they did not prove dependable, to watch over the sensitive parts and have them readily accessible. With increasing experience, higher speeds were ventured, which as a matter of course, required enclosed structures. Where one still finds a pronounced open type of machine construction, it is either a matter of antiquated slow-running types, of large radial dimensions, or of elements whose operating reliability is still a matter of doubt."

Dr. Kummer thus emphasizes the desirability of enclosing the parts of a machine as much as possible. This enclosure of working parts can be accomplished much more economically by the use of arc-welded steel construction than by other means; and arc-welded steel enclosures or containers, properly designed, can be made of as good appearance as castings. Often, arc-welded construction is even more pleasing than cast construction for this purpose, because of the great flexibility of designs possible with this new fabricating method.

A sugar sander, manufactured by the Baker-Perkins Co., Saginaw, Mich., as shown in Fig. 4, is an excellent example of the improved appearance of a machine redesigned for arc-welded construction. The moving parts are completely enclosed and the machine is stronger and more rigid. The original machine is shown in Fig. 3. The new ma-

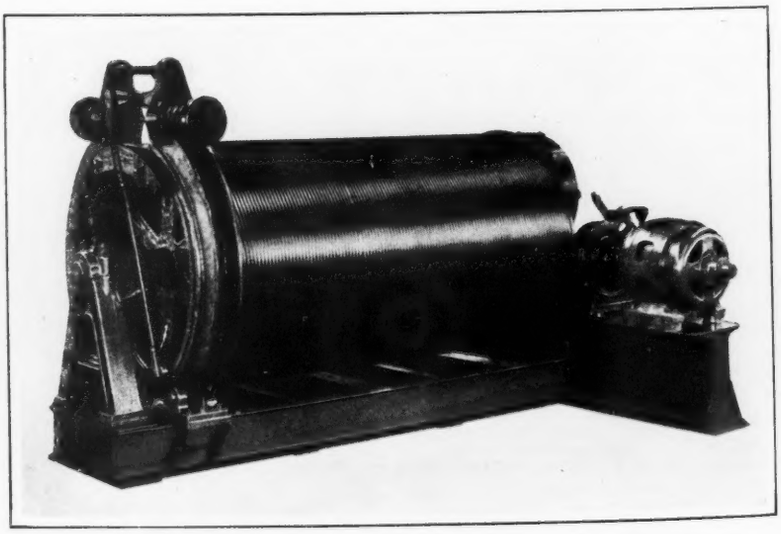


Fig. 2. Same Elevator Hoist as in Fig. 1 with Arc-welded Steel Base. Note Similarity of Appearance

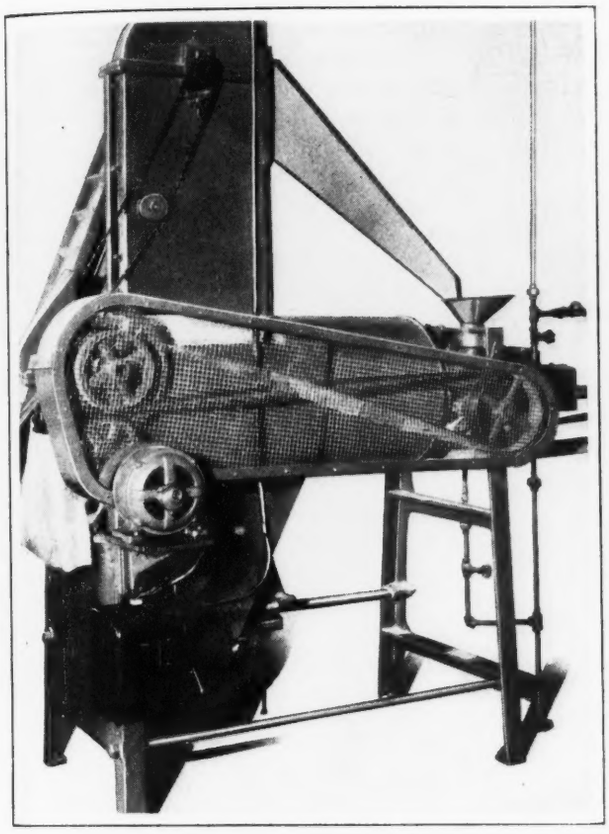


Fig. 3. A Sugar Sander with Cast-iron Frame

chine is so designed that it can be assembled or disassembled quickly, and all parts are readily accessible for cleaning. It was also necessary to keep the cost of this new machine equal to or less than its prototype; all these requirements are met by the rolled-steel, arc-welded construction shown.

Another point that is well illustrated in this sugar sander is that careful planning and designing makes it possible to conceal all welds. Many designers criticize arc-welded construction on the ground that the exposed welds are unsightly. The machine, as shown in Fig. 4, has no welds exposed, and its smooth surfaces, which are easily painted and cleaned, give it a most pleasing appearance.

Advantages of Welded Construction

A steel enclosure or container fabricated by the arc-welding process can be made to fit the machine perfectly, and at the same time be made exceptionally strong and durable without excessive weight. Any necessary doors or openings can be correctly placed and conveniently shaped, with the least trouble, by this process. When an enclosure is produced by casting, it is necessary to make it heavy, and the cost runs high because of the limitations placed on the design of castings by the molding and casting requirements. Patterns and cores are necessary to place the doors or openings properly, and often they cannot be placed where they serve the best purpose on account of molding difficulties.

A spot welder manufactured by the Cincinnati Electric Welders, Inc., Cincinnati, Ohio, shown in Fig. 5, illustrates the type of enclosure in which convenience is a primary requisite. The entire framework of this machine, shown in Fig. 6, is composed of structural angles fabricated into one piece of steel by the arc-welding process. The design of the main front and back members of the frame is unique. Each of these two members is made from one piece of structural steel angle. Where the angle is to be bent acutely, the vertical leg is notched with a V-shaped notch, so that after bending, the edges of the vertical leg notch come into contact with each other; they are then arc-welded together. The cross-braces and transformer supports are arc-welded to the main members to form the frame. Small pieces of plate are arc-welded to the ends of the main members of the frame to form the feet.

The front and back panels of the frame are of sheet steel, arc-welded to the frame members. The side panels are bolted in place to give accessibility to the transformer which is housed in the upper portion of the frame. The door in the side of the machine is of sheet steel, to which the hinges are attached by electric rivets. The hinges are attached in the same manner to the frame.

The plane surfaces in this machine show the modernistic tendency noticeable in the latest designs of many products. Smooth, even lines and rounded corners seem to have been criterions of appearance in the past, as far as machine design was concerned. However, these curves and lines were not adopted by the designer wholly on account of appearance. They have been the result of the limitations and requirements of molding cast iron. Today, however, the trend toward modernistic art

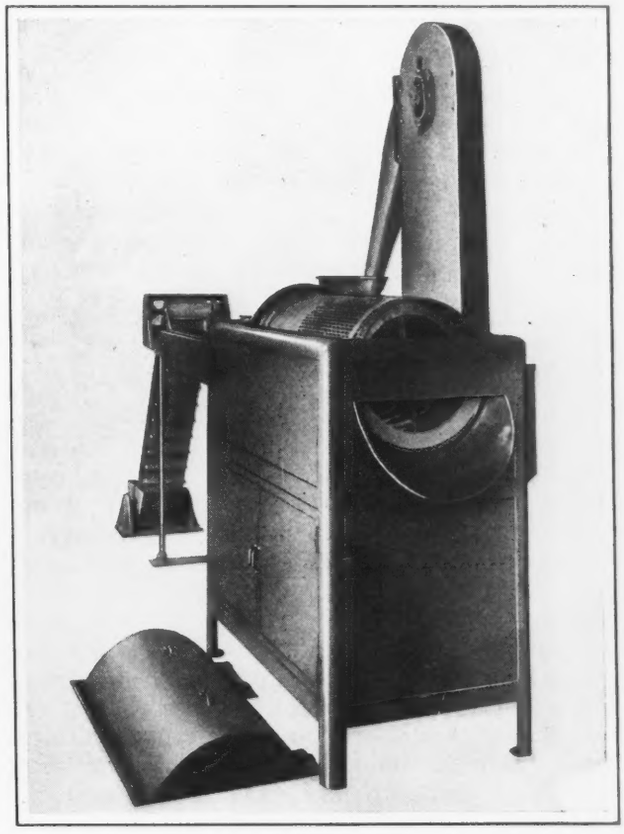


Fig. 4. Redesigned Machine of the Type Shown in Fig. 3 Built from Arc-welded Steel

has brought about a change, and through the use of arc welding, the designer finds it possible not only to obtain a more definite design, but also to employ squared and abrupt corners where they are advisable. Modernistic lines give machines an appearance of great strength and rigidity, and as we have seen, a machine whose appearance suggests these qualities is generally looked upon as being good mechanically. Arc-welded steel construction readily permits the adoption of modernistic lines.

Appearance of Castings May be Simulated in Welded Construction

Where it is imperative or desirable to retain curved lines or rounded corners in machine design, it is possible to do this with arc-welded construction and to obtain practically the same appearance as in a cast machine. These curving fillets or rounded corners in sheet steel or plate can be formed on a bending brake. Often complicated parts that were formerly cast can now be produced economically by stamping these parts out of rolled steel; the high cost of complicated dies may be avoided by breaking down the intricate dies into simple dies which will form component parts. These parts fabricated by the electric arc will form the desired original complicated part, which will be of one piece of steel, by virtue of the electric arc fusing metal into metal. Parts thus formed are given the appearance and strength of a single, solid piece of rolled steel.

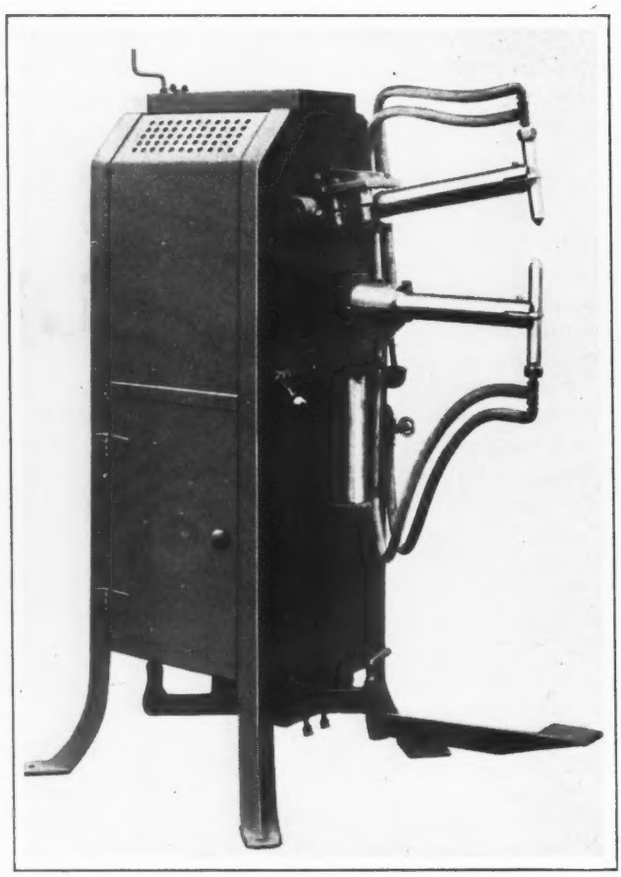


Fig. 5. A Spot Welder Fabricated by Arc Welding, Having Smooth Even Surfaces

Fig. 6. The Arc-welded Steel Frame of the Spot Welder Illustrated in Fig. 5

As previously mentioned, close attention should be paid to the matter of appearance. It has been shown that neat and attractive appearance, durability, and efficiency are closely linked together in the design of any piece of mechanical equipment, and have an enormous value in modern merchandising. For some time after the introduction of the arc-welding process, designers whose primary aim was appearance, hesitated to adopt this process. Today, however, its extensive use in practically every industry gives ample proof of the potentialities of the arc-welding process.

Those in the machinery industry should take note of what Henry Ford thinks about welding. He, like many other leaders of industry, believes that even though the arc-welding process is still in its infancy, it is only a matter of time when it will be employed in place of other processes and methods of fabrication to improve the efficiency and appearance of machinery and other metal products.

* * *

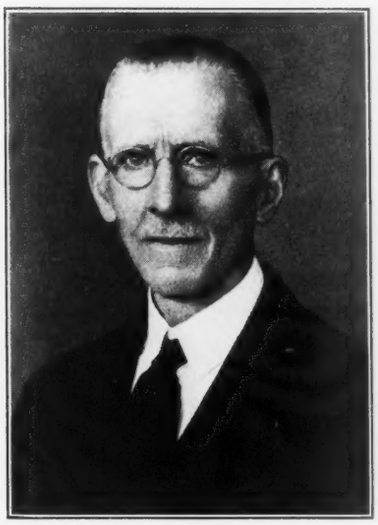
As a result of a meeting held in New York February 14, attended by white metal smelters and manufacturers from various parts of the country, the Institute of White Metals has been formed. The following temporary officers have been elected: L. Muscat, United American Metals Corporation, Brooklyn, N. Y., chairman; Walter Schoenbach, American Lead Co., Indianapolis, Ind., secretary; J. Katz, American Metal Co., New York, treasurer.

Methods of Measuring Tapered Bores

Analysis of Methods of Measuring the Diameters of Tapered Holes, Both in Duplicating and in Originating a Tapered Bore

By WILLIAM S. ROWELL

So far as is known to the writer, no mechanical handbook offers machinists and toolmakers any help in the difficult task of measuring tapered bores. The seventh edition of MACHINERY'S HANDBOOK, page 1031, gives information and formulas for use in measuring external tapers and tapers between planes, but leaves us to work out our own methods for measuring taper bores.



William S. Rowell

The late J. B. Thomas of the Westinghouse Electric & Mfg. Co. devised a simple method for measuring slightly tapering bores that are relatively deep and not too small in diameter. The method is illustrated by the diagram Fig. 1, which shows a longitudinal section of the bore with the gage *S* in position. Gage *S* consists of a strap of steel bent at one end to provide a positioning shoulder, and having as many countersunk holes for locating the ball point of the inside micrometer as is deemed advisable for the particular bore to be measured.

It will readily be seen that while this instrument would serve very well as a means of duplicating work, it would be lacking in accuracy and convenience in originating a taper bore. To keep within the present meaning of accuracy, not only would distances *a*, *b*, and *c* have to be calculated from the dimensions *A*, *B*, and *C*, but the inside micrometer *G* would have to be provided with proper ball contact points, and a calculation made to determine the proper reading at each of the positioning holes in gage *S*. As shown, micrometer measurements at these points are not taken on diameters, each being along the base *fd* of a triangle such as *edf*.

Suppose we wish to produce the taper bore shown in Fig. 2. Provided with a ball-pointed inside micrometer and balls *M* that are large enough to hold the body of the instrument off the bottom of the bore, the work would proceed until *X* equaled the size obtained by applying the formula

$$X = B - \tan\frac{x}{2} D + D$$

Substituting the values given,

$X = 4 - 0.57735 + 1 = 4.42265$ inches

The dimension *Y* is found by the formula,

$$Y = A - \cot\frac{x}{2} D + D$$

In this case,

$Y = 6.3094 - 1.73205 + 1 = 5.57735$ inches

As is known to all toolmakers and machinists, manufacturers have not yet put an instrument on the market for measuring taper bores in the manner described. If one is placed on the market, there will probably be many cases where the bore will be found to be too small to admit the instrument. Facing the need for such a

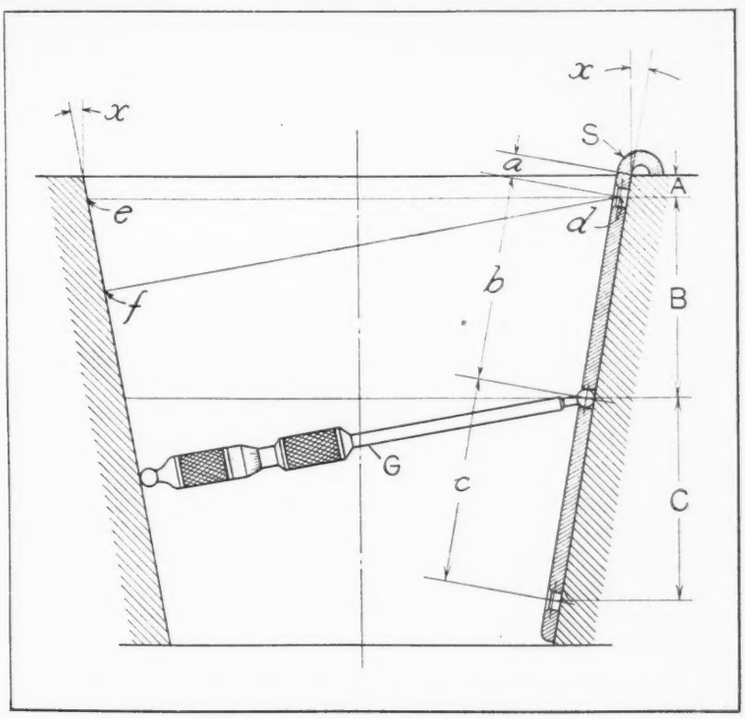


Fig. 1. Diagram Illustrating Method of Using Inside Micrometer and Guide S for Measuring Taper Bore

WILLIAM S. ROWELL has been a regular contributor to MACHINERY for many years. He has been engaged in mechanical work for over forty years and has had a broad and varied experience in tool and instrument work and in inspection methods. After having gained a thorough experience as toolmaker, he became tool-room foreman of the Brown Hoisting Machinery Co., Cleveland, Ohio. He has also been with the Western Electric Co. as inspector for six years and with the Westinghouse Electric & Mfg. Co. for six years, most of the time serving as chief inspector at the Engine Works of the British Westinghouse Electric & Mfg. Co., in Manchester, England. Mr. Rowell has always taken a great deal of interest in measuring methods and precision measuring instruments.

device, the writer was happy in solving the problem as shown in Fig. 3. The shell N is of any suitable metal. In this case, a fairly stiff phosphor-bronze was used, which was rolled about a 1/2-inch rod and given enough tension on the 1 2-inch balls to prevent their moving easily. This shell is cut away, as shown, to allow the balls to bottom in the bore.

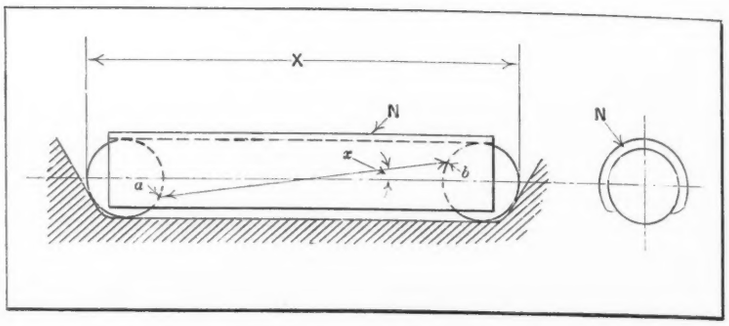


Fig. 3. Device for Holding Balls Used in Measuring Taper

In preparing the device for use, the balls are pressed outward until dimension X is slightly greater than when the device is in the position shown. One of the balls is then placed in position and the gage depressed until the balls bottom without shake and make contact with the bore at diametrically opposite points. The gage is then removed and the dimension X measured with an outside micrometer. It may be argued that such an instrument requires careful handling. The reply is that any and all measuring instruments must be handled carefully. Also that no instrument can be fool-proof. More depends on the man than on the instrument.

When large numbers of highly accurate taper bores are to be produced, especially bores of small diameter, the Winchester system of sectional gages, or some modification thereof, is applicable, provided the very considerable outlay of time and money is warranted.

In improvising ball contacts for an inside micrometer, it must be borne in mind that the center of the balls must coincide with the center line of the micrometer; otherwise the effect shown exaggerated by angle x, Fig. 3, would vitiate the measurements taken by the movement of the micrometer screw. Such a movement, being along the line ab, might introduce an error of 0.001 inch, assuming the micrometer is only 2 inches long and angle x is only 2 1/2 degrees. An error of this kind can be readily avoided by measuring over the ball points with an outside micrometer. A gage of the design shown in Fig. 3, however, is not subject to this error.

It is also admitted that the instrument and method here described are not applicable to the measurement of bores of excessive taper. For instance, if angle x, Fig. 2, were 60 degrees or more, difficulty would be experienced in securing perfect contact of the balls with the work at all four points at the same time. In such a case, more accurate results will be obtained by measuring the large end of the bore, using a straightedge as shown in Fig. 2. The same equation used in finding Y would be used in measuring the size of the bottom of a reverse taper bore. Balls or cylinders can also be used in a manner similar to that described for measuring between plane surfaces other than parallels, including such work as dovetail slides.

* * *

FOREIGN TRADE CONVENTION

The National Foreign Trade Convention will be held this year in Los Angeles, Calif., May 21 to 23. The Los Angeles Chamber of Commerce will be the host to the convention, and the Pacific Foreign Trade Council, comprising business men and manufacturers engaged in foreign trade in the Pacific Coast states, will also meet in conjunction with the national gathering. The Los Angeles committee in charge of local arrangements is headed by J. A. H. Kerr, vice-president of the Security First National Bank, Los Angeles. Business men from many foreign countries, especially from the Far East and Latin America are expected to attend, and arrangements are being made for the promotion of informal contact with these representatives from outstanding fields for American foreign trade.

* * *

The saving of labor through the use of a conveyor system is well illustrated in a paper by R. H. Hucke of the General Electric Co., Schenectady, N. Y., read before the American Society of Mechanical Engineers, March 7, at Chicago, Ill. It is mentioned that for the General Electric refrigerators approximately nine carloads of insulating materials are handled from the cars to storage, and thence to the assembly lines, every week. To handle this material without a conveyor system would require a crew of from fifteen to twenty men and a fleet of trucks. With a conveyor system, from four to six men handle all this material with no congestion. This example of labor saving may be suggestive of similar applications in other lines.

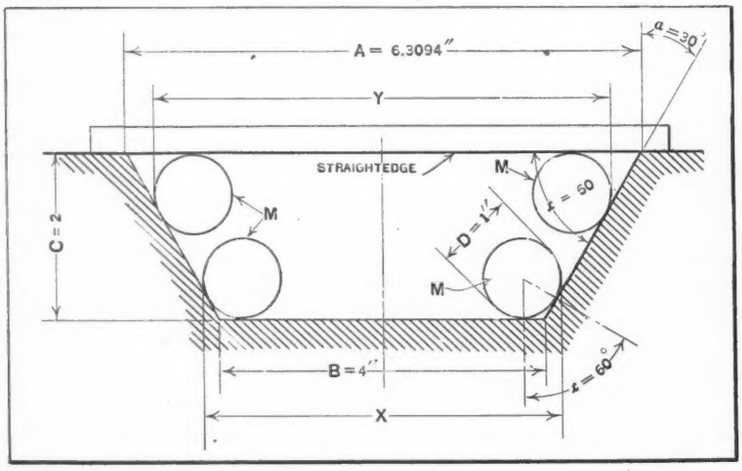


Fig. 2. Method of Using Balls in Measuring Taper Bores

Tapping Brass Fittings with Tap of Unusual Length

Brass lubricator fittings of 1 4-inch size, thirty-two threads per inch, are tapped at the rate of twenty pieces per minute at the plant of the Alemite Corporation, Chicago, Ill., by using the special equipment illustrated. This machine employs a straight tap having a cutting portion 1 1/4 inches long and a shank 16 inches in length. The fittings are fed on the cutting end of the tap gradually, and are forced along the shank by succeeding fittings until the shank is full. Then the tap is disengaged automatically from the driving chuck, and the operator lifts it out of the machine, permits the fittings to slide into a box, replaces the tap, and finally starts the machine again.

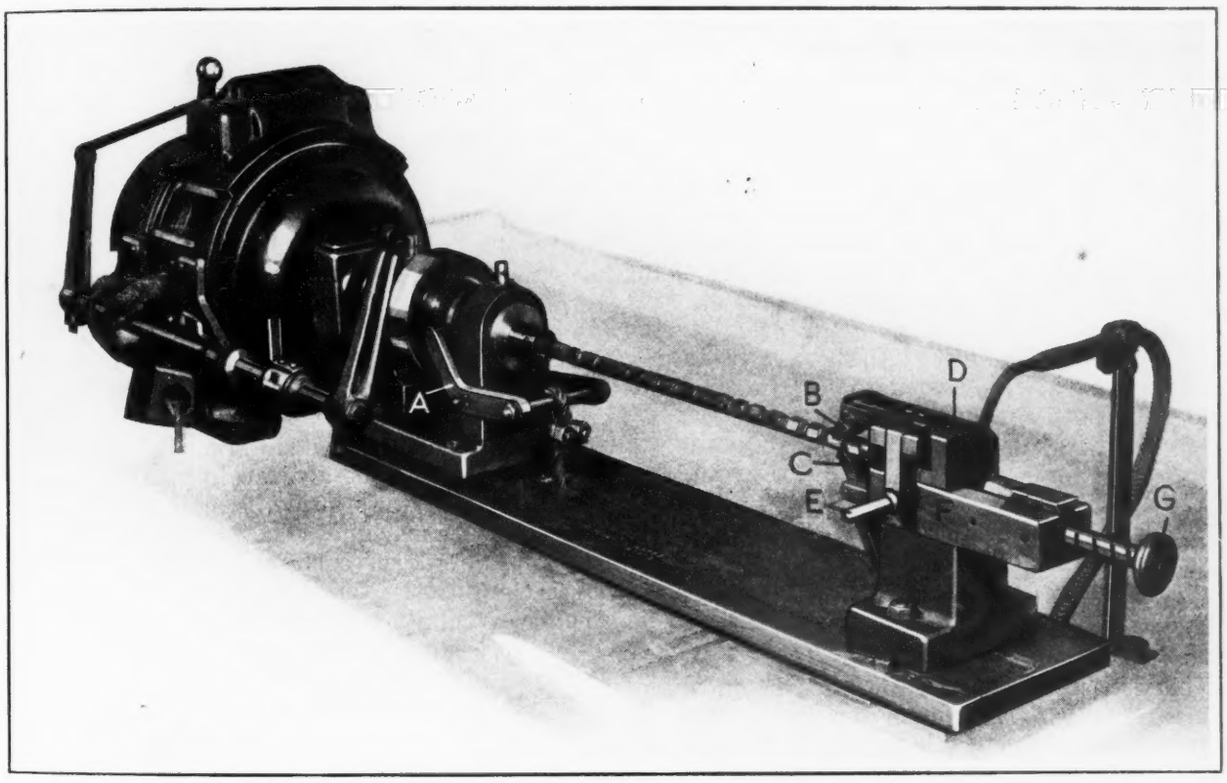
The tap is driven by a variable-speed motor running at speeds ranging from 550 to 1350 revolutions per minute. Power is transmitted from the motor to the tap chuck through a clutch which is engaged and disengaged by operating crank *A* through a foot-treadle. At the cutting end, the tap is steadied by two spring-actuated members *B* and *C* which rest on the shank at the beginning of an operation and are moved outward as the fittings are forced between them. To facilitate removing and replacing the tap, the upper section *D* of the tailstock unit can be raised after handle *E* has been unlocked.

It is important that these fittings be tapped with the pitch diameter to size within plus or minus 0.002 inch and with the threads concentric with other threads, within close limits. To insure accuracy, the fittings are located in vees in blocks *D* and *F* as they are pushed on the tap. They are advanced on the tap as the operator exerts pressure on handle *G* and, of course, when the thread has once been started, the tap pulls each fitting along automatically. Cutting lubricant is fed to the working end of the tap through piping, as shown.

* * *

CASTING CYLINDERS IN GREEN SAND

Automobile cylinder blocks, because of their shape and complicated arrangement of water jackets, valve passages, pockets, and bearings, are difficult to cast and require a large quantity of cores. These are generally baked or dry-sand cores. In a paper presented before the annual meeting of the Society of Automotive Engineers at Detroit last January, D. J. Campbell, president of the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., pointed out that his organization has been successful in making the more bulky cores—those for the cylinder barrels and crankcase—in green sand. He described two methods of molding a six-cylinder block in green sand. In order to realize the economy possible with this method of molding—which results largely from the great saving in the cost of sand—there must be cooperation between the designer and the foundryman. Those interested in this subject can obtain copies of the paper from the Society of Automotive Engineers, 29 W. 39th St., New York City.



Special Machine Designed for Tapping Brass Fittings at High Rates of Production

What MACHINERY'S Readers Think

A Department for the Interchange of Ideas on Problems of Management, Foremanship, and Employe Relations

GAINING THE GOOD WILL OF EMPLOYES

With the establishing of shop cafeterias, benefit societies, group insurance, vacations with pay, and free parking space for automobiles, a spirit of lasting good will is being created between men and management.

Certain corporations are now adding another privilege to those already mentioned. When an employe wishes to buy anything, from a radio to a wrist watch, the services of the purchasing agent are placed at his disposal so that he may get the benefit of the discount usually allowed on goods purchased by the company. This feature, together with that of allowing thirty days in which to pay, tends to attract workers to the plants of the company granting this money-saving opportunity. Another company, noted for its success in keeping its employes satisfied, permits them to buy any of the articles carried in the company's storeroom. The company makes no profit on these sales, as the goods are sold at cost price. All these services have been found to be amply repaid by the good will engendered among the employes.

SAMUEL KAUFFMAN

EXPLICIT SPECIFICATIONS FOR PURCHASED UNITS

A large number of manufacturers use parts or units produced by outside firms. These parts or units, such as motors, clutches, driving chains, etc., are either assembled or built into the manufacturer's product. Each item purchased must be correctly and completely described by the purchasing department in order to prevent trouble in assembling. It is of mutual advantage to the buyer and the seller that this description be clear and proof against misinterpretation.

No difficulty is experienced in purchasing a standard unit or part, but in many cases the standard article cannot be applied economically unless certain changes or modifications are made. For example, one manufacturer has the oil pan left off the engine purchased for one of his products, and orders the bottom flanges of the crankcase drilled to match the holes in a base made in his own plant. This is only one of many modifications made in this particular engine to meet installation requirements. Obviously, the buying specifications for this engine must be so explicit that the engine builder will have no cause for uncertainty or hesitancy in making the desired changes.

It has been the writer's experience that the average manufacturer pays too little attention to his buying specifications when he orders a modified form of a standard product. This results in much correspondence and unnecessary expense before a definite understanding is reached.

A good method to follow in compiling buying specifications is to put one's self in the place of the manufacturer to whom the specifications are to be given, and thus make sure that he will get the exact information required. The use of definite drawing numbers should be encouraged, and concise words should be employed in writing specifications. Brevity is a good thing, but too much information is better than not enough. HAROLD R. GOODRICH

A NEW ATTITUDE TOWARD THE MACHINE AGE

In the earlier days of machine production there was a tendency to consider hand-made products superior to those made on machines. The machine produced a greater quantity than the artisan, but the quality of the product often failed to meet the high standards that the artisan's pride in his work demanded; consequently, he didn't take kindly to the machine.

Today conditions are different, and those who criticize the machine age fail to take into account that the operator's pride is now centered very largely in the machine. The workers of today take great pride in the remarkable machines that produce many times more than a man could by hand methods and that reduce the manual labor and effort to a minimum, so that the mechanic mainly occupies his time in caring for the tools he uses.

Intelligent workers realize that this tends to keep them in better physical condition, and their mental attitude toward the machine has changed a great deal. The operator now recognizes that the automatic machine has eliminated numerous tedious small, but necessary, operations that made work dull and monotonous. He also sees that taking proper care of the tools used involves a high degree of skill, and that when the tools are properly cared for, the quality of the product is taken care of automatically. H. W. MORLEY

ENTERTAINMENT AT CONVENTIONS

To those who visit conventions and exhibitions for the purpose of bringing back valuable technical information, the great amount of entertainment frequently indulged in by some of the sales organizations of exhibiting concerns seems inimical to the best interests of industry as a whole. It is therefore with great interest that the writer notes that the American Oil Burner Association, in a bulletin recently issued, speaks out plainly against "lavish, unwarranted, and wholesale entertain-

ment," and asks exhibitors and others attending the association's seventh annual convention and the National Oil Burner Show, to be held in Chicago during the week of April 7, to cooperate in the "abatement of such practices."

The bulletin quotes a resolution adopted by the board of directors of the association. "Lavish entertainments," it is stated, "detract from and tend to defeat the purposes of conventions, reflect discredit on the men in the industry, and discourage companies from sending their representatives. They result in excessive, unnecessary, and unwarranted expenses, contrary to good business ethics and practice."

"The action of the American Oil Burner Association," the bulletin quoted states, "is in conformity with the stand taken recently by other organizations, including the American Foundrymen's Association, the Foundry Equipment Manufacturers' Association, the Association of Exhibition Managers, the National Machine Tool Builders' Association, and the Association of National Machine Tool Dealers."

OBSERVER

BEST WAY OF KEEPING MACHINES CLEAN

The practice of having a cleaning crew for keeping the machines in the shop in good condition is of doubtful value. This work can be done by the operator, perhaps even better, in a few minutes. It is all right to employ men especially for cleaning up the shop around the machines, but they should not be expected to clean the machines themselves. Every operator should be taught how to care for his machine properly. Different machines need to be cleaned and taken care of in different ways, and the men on a cleaning crew would not be likely to know of these differences in the machines. Fifteen minutes at the end of the week is usually sufficient time to allow a man for cleaning his machine, and it is time well spent.

MORTON SCHWAM

INTERVIEWING MEN TO BE HIRED

Recently the writer overheard an interview in an employment department. Six highly skilled men were required. The only questions asked of the applicants were: How much experience have you had? Where have you worked? Have you your own tools? How far do you live from here? Are you working at present? Then the applicant's name and address were recorded, and he was told that he would be notified when a man of his experience would be needed.

What I am wondering about is this: To what did the interviewer refer when he mentioned "experience"? He had not asked one question concerning definite experience. The man questioned claimed seven years' experience, but he was not asked as to what particular kind of experience.

I believe that industry is paying an enormous price by employing inexperienced men to hire skilled workers. Large amounts of money are also paid for advertising when a good employment man could fill most places without advertising, if he were capable of measuring a man's ability in the first place, and if a complete record were kept of the applicants whom he had interviewed in the past.

One employment manager carefully classifies every application for future use. Periodically he checks up as to whether the applicant wishes his name still to be kept on file. He adds on the application blank the names of any men now in the shop who live within a block of the applicant, so that they can do any checking-up that may be required. Employment departments that keep no records of applicants and rely mainly on newspaper advertising incur a heavy and partly unnecessary expense.

RUSSELL J. WALDO

ENFORCING SHOP RULES

Rules governing routine methods in the individual plant are as necessary as manufacturing equipment. Once established, they should be strictly enforced until changed or modified by the management. In general, rules in one department must harmonize with those in every other department. Thus each division, functioning independently, will dovetail in with the others and confusion and conflict will be avoided.

However, rules must not be so inflexible that exceptions cannot be made in cases where change would benefit the organization. A definite policy on revision or cancellation of old rules and promulgation of new ones is necessary in the shop. To break a rule without proper authority, however, is disastrous to shop discipline.

Outside of rules for the general conduct of the business, the fewer regulations there are, the better. Employes do not favor reading and remembering a long list of rules, and no well governed shop requires them to do so. If the foreman is a capable executive, he will control shop deportment and the men will respect his wishes without the support of endless regulations.

HARRY KAUFMAN

WHAT IS DEPENDABILITY WORTH?

Often the dependable man is taken too much for granted around the shop and his value is appreciated only after he has left. By a "dependable man" I mean one who is able to carry on his work without much supervision and who always does what is expected. In these days of high production, we frequently lose sight of this type of man, who, by doing the more difficult work around the shop without assistance, makes possible the high production of others on simpler work. It is this type of dependable man that makes it possible for the foreman to devote the larger part of his time to production. A busy shop meets with many unusual problems, and a man who can solve these without much supervision obviously is a valuable asset.

M. BUSWELL

Inexpensive Fixtures for Running-in New Tools

By ARTHUR ALDRICH, Hartford, Conn.

The cost of running-in new tools and machines may be considerable, yet it is an item that often escapes the attention of the manufacturer. The accompanying illustrations show examples of novel but inexpensive fixtures for running-in machines and tools so that they will be ready to operate at full capacity when installed. The fixtures shown are used in the plant of a large machine tool company and were devised by one of the shop men. With these fixtures the men can perform other work while the running-in operations are being carried out.

In Fig. 1 is shown an old lathe equipped for running-in the spindle quill in the head of a new centering machine. One end of the driving arm *A* is connected to the large faceplate of the lathe, and the other end to the hand-lever *B* of the centering machine. The eccentric action of the driving arm moves the hand-lever back and forth, causing the spindle quill to slide backward and forward in its bearing at a speed greater than that attained under ordinary manufacturing conditions. The plunger pump of the centering machine, which delivers a supply of oil at each stroke of the hand-lever, is used to supply the oil for the running-in operation. The oil is directed into an oil pocket in the housing in which the spindle quill is mounted. This makes it unnecessary for the operator to leave his work frequently to take care of the oil supply.

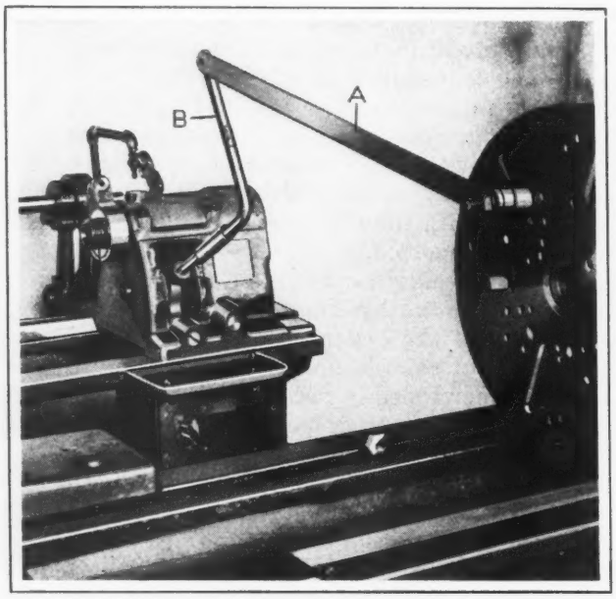


Fig. 1. Method of Using an Old Lathe for Running-in the Spindle Quill of a Centering Machine

In Fig. 3 is shown an obsolete centering machine employed to run-in the spindle mounted in the quill of a new centering machine. This spindle is run in excess of its rated drilling speed of 1000 revolutions per minute. Any inherent weakness or defect is bound to be exposed under such a run. The spindle quill *A* is held in a vise having self-centering jaws *B* and *C*, and is supported by a work-rest *D* at the other end to insure alignment. The spindle *E* is driven by a two-jaw chuck *F* equipped with a tube holding a socket *G* that fits over the spindle and nut, thus completing the driving connection.

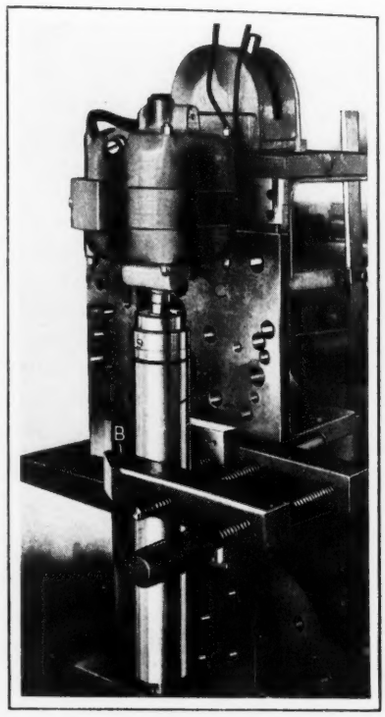


Fig. 2. Simple Set-up for Running-in Spindle of Small Precision Machine

A simple set-up for running-in the spindle of a small precision machine is shown in Fig. 2. The spindle quill *A* is held in position by a wooden clamp *B* of the type ordinarily used by carpenters. The spindle is driven by a small motor *C*. A brass connection fitted to the drive-shaft of the motor slides into a recess in the top of the spindle that is to be run-in. In this case, the spindle is revolved at a greater speed than under ordinary conditions, so that any defects will be easily discovered.

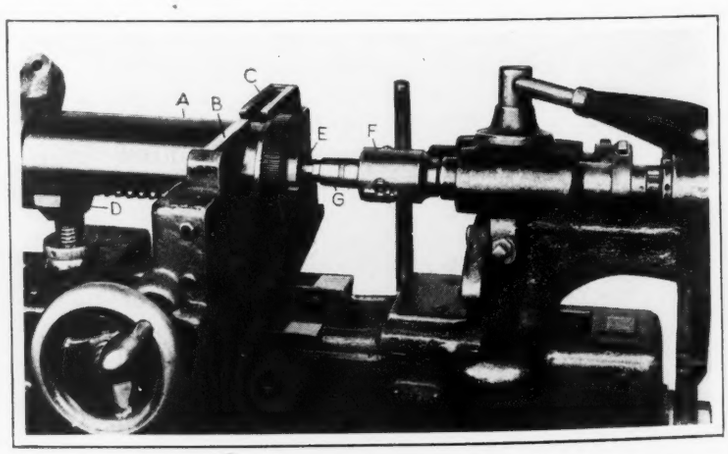


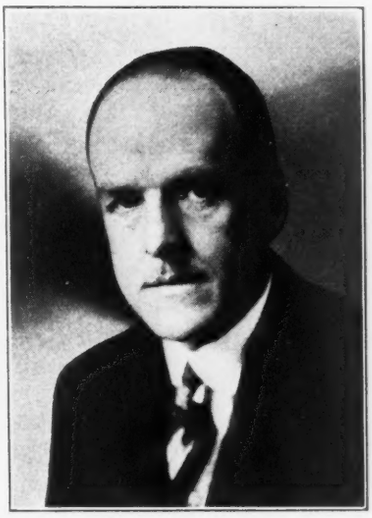
Fig. 3. Using an Obsolete Machine for Running-in the Spindle of a Centering Machine

The Problem of Designing for Production

The More Knowledge of Machine Shop Practice the Designer Has, the Better Will be His Judgment When Design and Production Problems Clash

By E. P. BLANCHARD, Bullard Company, Bridgeport, Conn.

THE designing of a product for production has even greater possibilities as regards economy than the designing of equipment for manufacturing the product, and the burden of responsibility for efficient manufacturing rests quite as much on the product designer as on the equipment designer.



E. P. Blanchard

The successful designer requires a broad knowledge of the machinery on which the products that he designs are to be made. He particularly needs a knowledge of the limitations of the machines used in production. This is truer today than it has ever been before, because at the present time the designer must be able to answer not only the question, "Will it work?", but also, "How much will it cost?"

Designing a product for quantity production, then, is quite as important as designing it for mechanical functioning. The success of a design hinges almost entirely upon the designer's ability to couple efficiency in the device with economy in its manufacture, particularly when equipment already available is to be used.

While the equipment installed and the methods used in the plant in which the designer is employed generally limit the means by which the part must be produced, reasonable consideration should also be given to other types of machinery on the market and other available methods. It may be possible to turn out a better and more easily manufactured design by the use of mechanical equipment recently developed. The purchase of such new equipment may be justified by the improvements in the design that the new methods of manufacture make possible.

The choice between different types of manufacturing equipment offered for the same purpose presents no small problem to the production engineer, but the designing engineer must also pay some attention to this choice. Features of equipment that will help to accomplish what is wanted in a new design, and the adaptability of machine tool equipment of a given type to the exact production requirements, present problems that can best be solved by cooperation between the designer and the production executive.

Cooperation between designers and production men is becoming more important than ever before. Refinements in design require refinements in production. The selection of methods and possible changes in design to meet simplified production methods will be most effectively accomplished by the harmonious and intelligent working together of the designing and the production departments.

Equipment may be available in standard form for the operations on a given design, while a refinement of the design may require equipment of special construction. It then becomes a problem of the design engineer to determine if the advantages of the refinement (always provided that it is not mere change) are sufficient, if the quantity involved is large enough, and if the change in design will be retained for a sufficient length of time to justify the cost of the special features required in the manufacturing equipment or method under consideration.

Usually the production man tries to combine and modify operations within the scope of available equipment, as he is particularly concerned with economy in production and is also thoroughly familiar with what his equipment can do or can be made to do. He proposes changes that should be approved by the designer, because even production requirements should not be permitted to cause a decrease in the efficiency of the equipment that is to be built.

The more knowledge of machine shop practice and available equipment the designer has, however, the better will be his judgment in questions where design and production requirements may clash. The designer who is primarily a designer and who knows little or nothing concerning the methods by which his work is to be transferred into iron and steel, is seldom very successful in a commercial enterprise.

E. P. Blanchard graduated in 1912 from Brown University in the civil engineering course. During the next three years he was engaged in tool and die design with the Osgood Bradley Car Co., and subsequently was with the Boston Pressed Metal Co., Worcester, Mass., as assistant to the general manager. In 1920 he went with the Bullard Co., Bridgeport, Conn., where since that time he has been engaged in advertising and sales work. Mr. Blanchard has written a number of articles on production and advertising for numerous publications, and has prepared many papers read before engineering societies. In recent years, he has also taken an active interest in the Production Division of the Society of Automotive Engineers, and has been chairman of the Production Division's Meetings and Program Committee.

PLACING DRILLS IN LINE FOR INSPECTION

When drills of the smaller sizes manufactured by the Morse Twist Drill & Machine Co., New Bedford, Mass., drop from the flute milling machines into tote boxes, they naturally fall with the fluted ends and shanks all mized up. For convenience in a succeeding inspection, as well as in subsequent operations, it is desirable that the drill ends reach the inspection department all pointed in the same direction in their receptacles. This is accomplished by the ingenious method shown in Figs. 1 and 2.

Drills of the same size, all mixed up with respect to their ends, are spread across base *A*, as shown in Fig. 1, and a stick *B* is laid just in front of the base. Then the girl pushes slide *C* forward until all drills lying with the shank ends toward the front, tilt downward, as illustrated in Fig. 2. The

Fig. 1. How the Drills are Spread Out in the Process of Pointing them all in the Same Direction

drills with the shank ends forward naturally tilt before the others, due to the greater weight of the shank end.

When the drills have been tilted, the girl pushes back the drills that have not fallen, then grasps stick *B* at both ends, and raising it quickly, flips the tilted drills end for end, and raising it quickly, flips the tilted drills end for end, so that all drills lie on the base with the shanks pointing toward the rear. The drills are then put back in pans which go to the inspection department.

One girl alone handles 50,000 drills per day, weighing them on a scale in addition to "ending" them by the method described.

* * *

The fittest to survive are those who do not think with other people's brains.—*Slices*

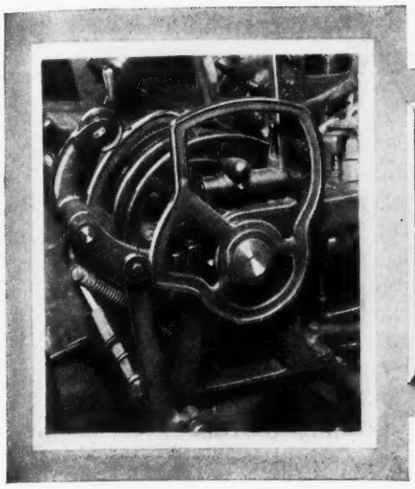
STATISTICS OF THE AUTOMOBILE INDUSTRY

The following statistical figures relating to the automobile industry in 1929 are based on information obtained from the National Automobile Chamber of Commerce.

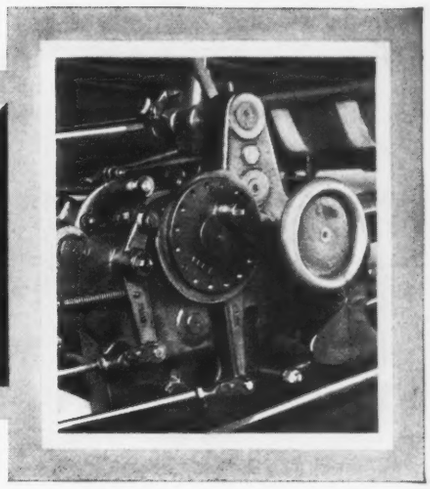
Cars and trucks produced in the United States and Canada	5,651,000
Cars	4,846,000
Trucks	805,000
Percentage of closed cars	87
Wholesale value of cars	$2,952,900,000
Wholesale value of trucks	$531,000,000
Wholesale value of cars and trucks	$3,483,900,000
Average retail price of cars	$812
Average retail price of trucks	$877
Wholesale value of parts and accessories for replacements, and service equipment	$920,000,000

Fig. 2. Just Before the Girl Raises the Stick to Flip the Tilted Drills End for End

Wholesale value of rubber tires for replacement	$600,000,000
Motor vehicles registered in the U. S.	26,400,000
Motor cars	23,030,000
Motor trucks	3,370,000
Motor buses in use	95,000
World registration of motor vehicles	34,700,000
Percentage of world's automobiles in the United States	76
Number of persons employed in motor vehicle and allied lines	4,300,000
Number of American motor vehicles sold outside of the United States	1,015,000
Value of motor vehicles, parts, and tires sold outside of the United States	$757,400,000
Percentage of production sold outside of the U.S.	18
Percentage increase in foreign sales over 1928	23
Number of motor vehicles imported, 1929	710
Total car and truck dealers	56,300
Service stations and repair shops	95,800



Ingenious Mechanical Movements



AUTOMATIC SPEED COMPENSATING MECHANISM

By CHARLES L. HEISLER

In recording sound on a sensitized motion picture film, it is necessary that the film have an absolutely uniform linear movement through a microscopic light beam which photographs on it electrical vibrations coming from a microphone. This film is pierced at the time it is manufactured with two rows of very accurately spaced sprocket holes. The pitch of this spacing changes from film shrinkage —when the film is aged by being stored, or otherwise—often as much as one-half per cent; that is, five feet per thousand feet of film. When new film is used for recording sound, sometimes there is no shrinkage at all. Most frequently, however, it will be found that the shrinkage amounts to about one-fourth of one per cent.

Since an absolutely uniform motion of the film is necessary for perfect sound recording, means must be provided to compensate for this shrinkage and thereby maintain synchronism between the sound record and sprocket holes, because the sound track record must synchronize with the pictures being taken by one or more cameras operated in synchronism with one or more sound recorders.

Referring to Fig. 1 (view at the left), the sprocket *A* causes the film *B* to travel in synchronism with a film passing through a corresponding camera, because the camera and sound recorder are actuated by synchronized electric motors. The film, after passing under the control roller *C* and over the roller *D*, snugly engages the drum *E* and is thereby caused to pass, with an absolutely uniform motion, through a microscopic oscillating light beam coming from a galvanometer, as indicated by the dotted line *F*.

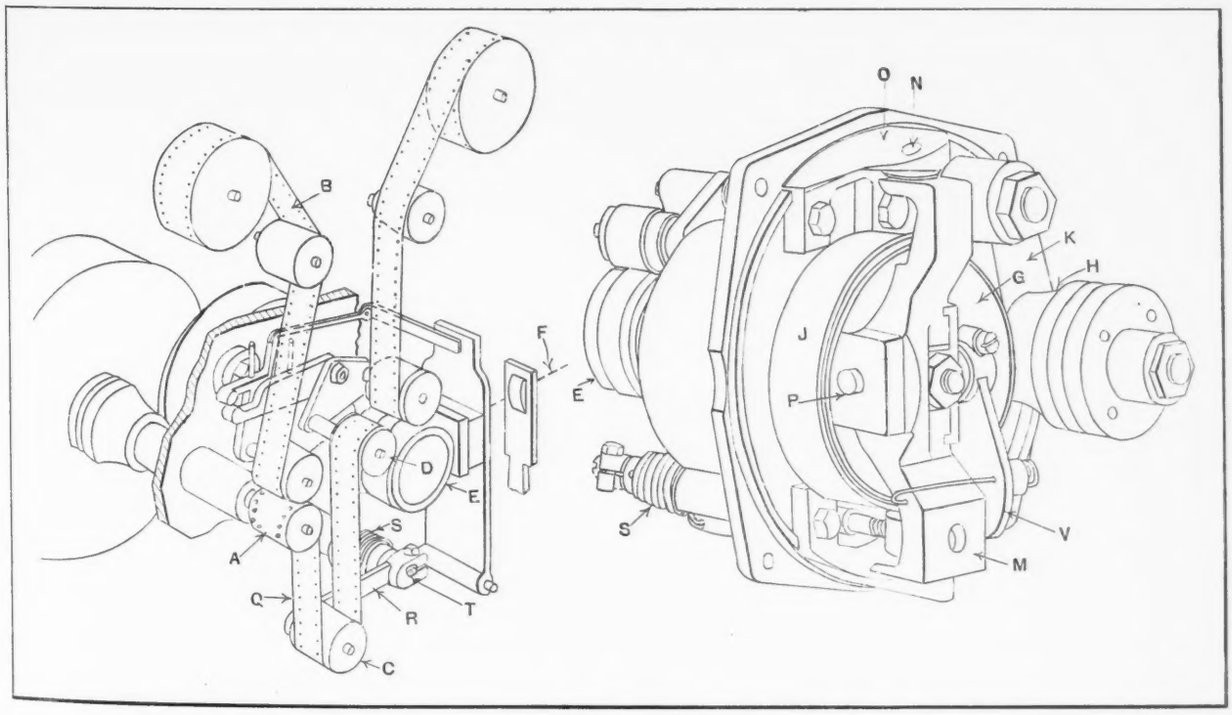


Fig. 1. Automatic and Precise Speed Compensating Mechanism for Maintaining Synchronism between Sound Record and Moving Picture Film Movement

Evidently, if the film has shrunk considerably, the periphery speed of the drum *E* must be correspondingly reduced in such a precise manner as to maintain the required uniformity in rate of film travel through the light beam. That is, the speed compensating mechanism about to be described must automatically select and maintain a speed ratio between the sprocket *A* and the drum *E* with a high degree of precision for the purpose of maintaining this uniform speed.

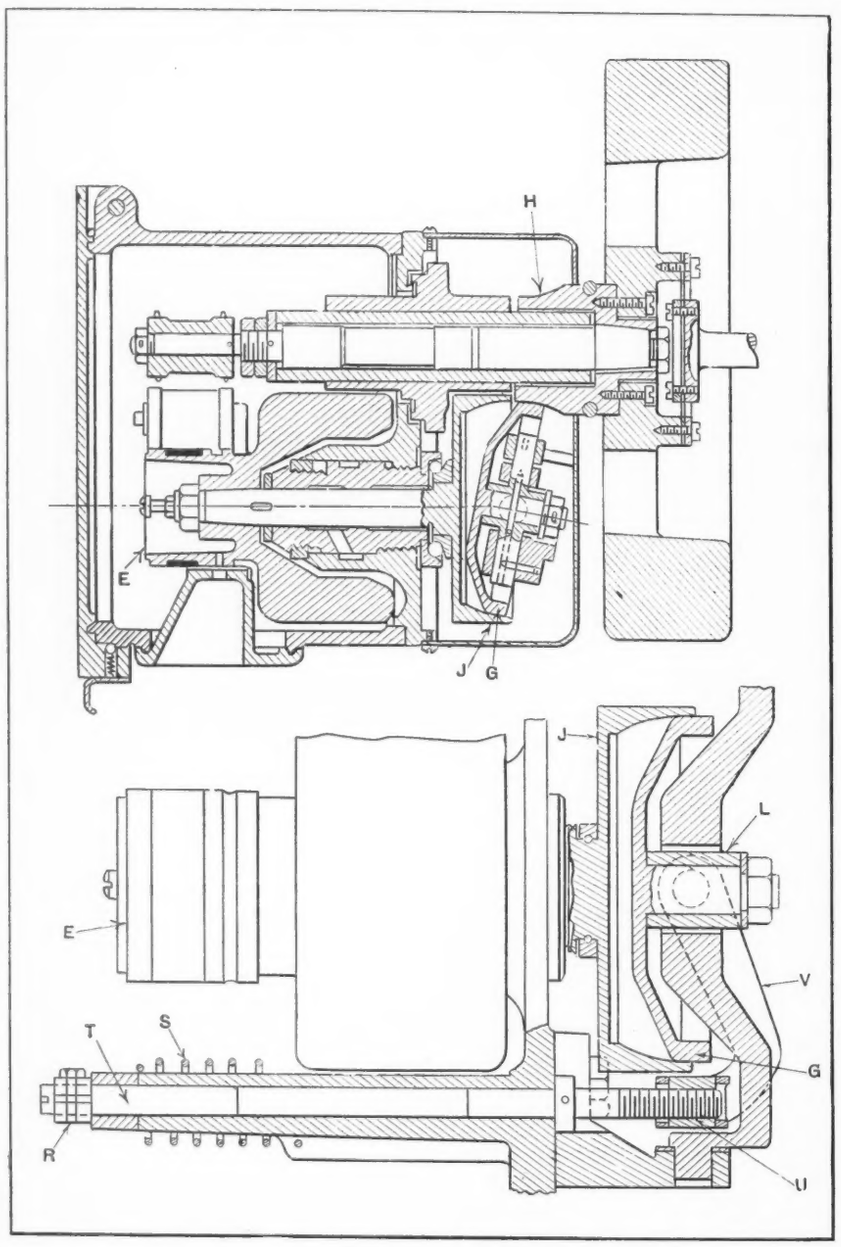


Fig. 2. Sectional Views, Showing how Minute Speed Variations are Obtained

The perspective view at the right in Fig. 1 shows the mechanism as seen from the side opposite to that shown by the view at the left. Sectional views are shown in Fig. 2. By referring to these illustrations, it will be seen that control wheel *G* transmits motion from the driver *H* to the driven wheel *J* and drum *E*. The frictional contact between these wheels is maintained by a spring (not shown), which presses the driver *H* and its hinged bearing arm *K* toward the control wheel *G*.

The control wheel is journaled in a gimbal mounting formed by the members *L*, *M*, *N*, *O*, and *P*. The position of the control wheel is governed by the film loop *Q* through the control roller *C*, lever arm *R*, spring *S*, control screw shaft *T*, nut *U*, and a swivel connecting with lever *V*. This lever is keyed to the trunnion *P* formed on the journal bearing *L* that supports the journal which is part of the control wheel *G*.

Owing to this construction, a very slight change (1/64 inch) in the position of the control roller *C* causes a corresponding change in the position of the control wheel *G* with respect to the driver *H* and driven member *J*. The friction contact surfaces between *G* and *H* are ground spherical, with great precision. The periphery of *G* is given a slight crowning to provide an actual contact friction driving surface of approximately 1/8 inch width. The slightest movement of the lever *V* tilts the control wheel *G* about its contact points with the wheels *H* and *J*, so that it automatically engages a new friction path that gives a corresponding change in speed ratio. Any slight wear or lost motion that may occur is taken up by means of springs.

In the apparatus, the arm *R* is 2 inches long, and a 1/64 inch movement of the control roller *C* gives approximately 1/800 turn of the screw shaft *T*, which has a double thread of 1/7 inch lead; consequently, the axial movement of the nut *U* is approximately 0.0002 inch. This slight movement of the nut automatically causes a new selection of speed ratio, thereby giving an extremely high degree of refinement in speed control. A very short time after starting under normal operating conditions, when running uniformly shrunk film, there is no appreciable change in position of the control roller *C* and its related parts.

Many sound recorders embodying the control mechanism described in the foregoing have been in successful operation for some time. The original model was developed in the Schenectady engineering laboratory of the General Electric Co. and operated daily over a period of two years, continually making perfect sound records without the least trouble.

HOPPER FEEDING MECHANISM

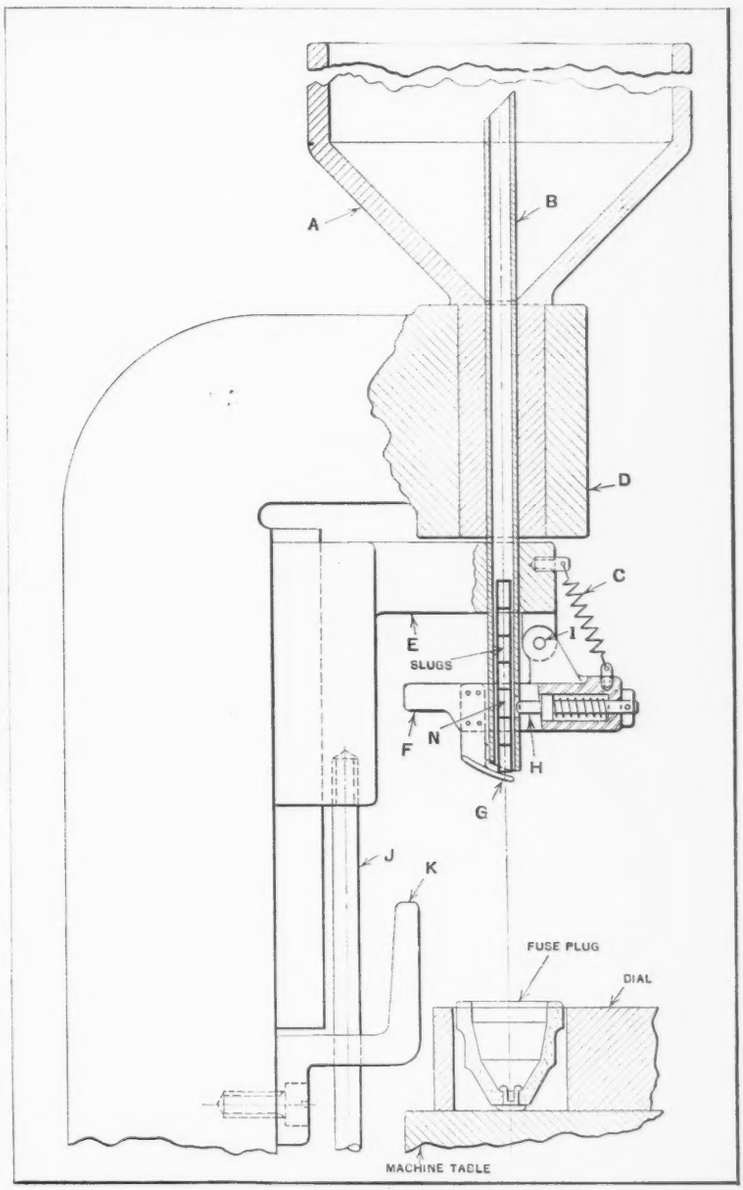
By J. E. FENNO

In manufacturing electrical fuse plugs, such as those used for house circuits, a thin fuse strip is soldered to a split rivet that has previously been assembled into the plug. The soldering is done on a special indexing dial machine in which the solder slugs are automatically dropped on the rivet on the inside of the plug. In another position of the dial, the plug dwells under a concentrated gas flame long enough to melt the solder slug. At the next station the operator places one end of a fuse strip in the molten solder. The dial is then indexed to another position where the plug is automatically ejected from the machine.

A detail view of the mechanism for automatically feeding the solder slugs is shown in the illustration. The dial indexes intermittently and is shown with a plug in position to receive two slugs which are held up in the end of the tube *B* by the stop *G* riveted to the arm *F*. This arm swings on the pin *I* and is normally held in position by the coil spring *C*.

The hopper *A* is fastened in the boss *D* of the machine by a set-screw. Slide *E* carries arm *F* and tube *B*, and receives a vertical reciprocating movement through rod *J*, from a cam located on the machine. The slide completes one cycle during the indexing of each station. The top of tube *B* is cut at an angle to produce greater agitation of the slugs in the hopper. The slugs, collecting in the tube as the latter passes through the supply in the hopper, drop down on stop *G*.

At the end of the down stroke of slide *E*, the stop *K* engages projection *F*, swinging the latter up to the left. This motion withdraws stop *G* from the end of the tube and allows the two bottom slugs to drop out and into the fuse plug. Just before this happens, however, the spring-actuated plunger *H* forces the slug *N* against the side of the tube, holding back the flow of slugs until the return stroke of slide *E* disengages members *K* and *F*, permitting stop *G* and plunger *H* to return to the position shown in the illustration.



Hopper which Delivers Two Solder Slugs to Each Fuse Plug in Soldering Machine Dial

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REGIONAL MEETING OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION

The first regional meeting ever held by the American Foundrymen's Association in cooperation with a district foundrymen's association took place in Moline, Ill., on March 26. The event was sponsored jointly by the American Foundrymen's Association and the Quad City Foundrymen's Association. At the technical session various papers covering different problems in the foundry field were read, and several round table luncheon meetings were held.

APPLICATIONS OF NEW TOOL STEELS

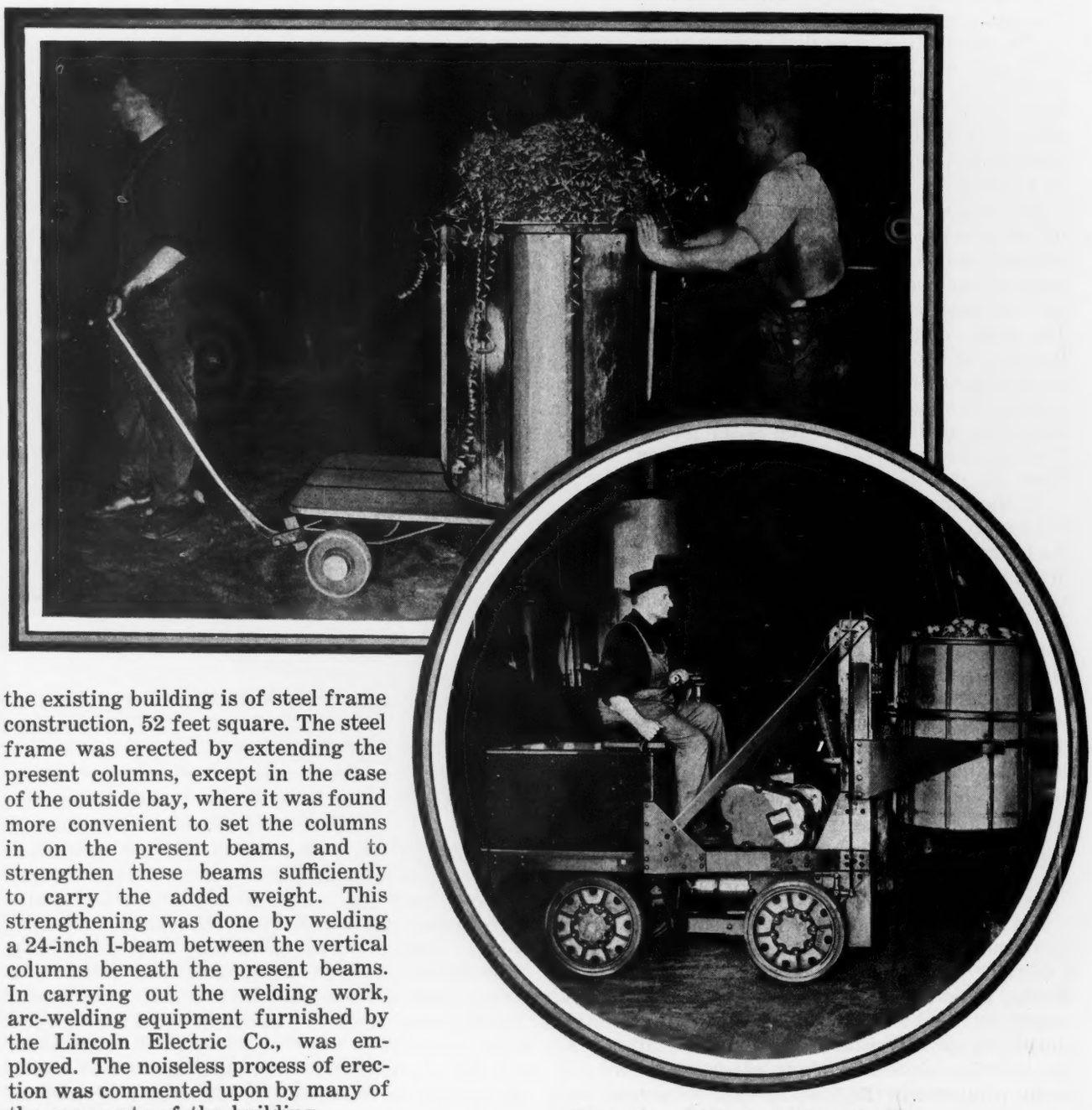
In an address before the Cleveland branch of the American Society for Steel Treating, A. H. D'Arcambal of the Pratt & Whitney Co., Hartford, Conn., discussed broadly the subject of the development of tool steels. A few of the points brought out were as follows: High-speed steels now generally used contain about 18 per cent tungsten, from 1 to 1.25 per cent vanadium, from 3.5 to 4.5 per cent chromium and about 0.7 per cent carbon. Quite a large amount of cobalt tool steel is also being made, the cobalt running from 8 to 10 per cent. Cobalt gives rough turning tools longer life. High-carbon, high-chromium tool steel is used to a large extent for dies and for some types of gages. The nitralloy steels are excellent for drawing dies. Improvements in their toughness will make them still more valuable for this purpose. Experiments are now being conducted on nitriding a high-speed steel containing 1 per cent aluminum.

Notes and Comment on Engineering Topics

As an indication of the resistance of wrought iron to the influence of time and the elements, it is stated that the British clipper *Falls of Clyde*, the sides and framework of which are made from wrought iron, is as seaworthy today as when it was launched at Glasgow, Scotland, fifty years ago.

Electric welding was employed in the erection of an additional story to the building of the Union Trust Co., Cleveland, Ohio. The addition on the top of the existing building is of steel frame construction, 52 feet square. The steel frame was erected by extending the present columns, except in the case of the outside bay, where it was found more convenient to set the columns in on the present beams, and to strengthen these beams sufficiently to carry the added weight. This strengthening was done by welding a 24-inch I-beam between the vertical columns beneath the present beams. In carrying out the welding work, arc-welding equipment furnished by the Lincoln Electric Co., was employed. The noiseless process of erection was commented upon by many of the occupants of the building.

Buffing wheel manufacturers, distributors, and users during a recent conference, approved of a simplified practice recommendation in which 4-, 5-, 6-, 7-, 8-, 11-, 13-, 14-, 17-, 18- and 20-inch full-disk buffing wheels were chosen as standards for stock. The action of this conference resulted in a reduction from seventeen different diameters to eleven standard sizes, as indicated, corresponding to an elimination of 35 per cent of needless varieties. The conference also voted that 20 ply should be adopted as standard for stock buffs.



Old and New Methods of Removing Chips

Bonus for Beginning Work on Time

By ELTON STERRETT

In a shop operating on the piece-work system, the men often reported late for work, especially during the winter months. Production throughout the plant had been figured for a nine-hour day beginning at 7 A.M., and all departments were scheduled on that basis. Many of the machine operators, however, could turn out a day's pay in eight hours or less, and consequently were lax about arriving on time.

First an attempt was made to correct the trouble by fining the men. Each man was given a basic hour rate at which he was supposed to be paid when not actually on piece work. Inasmuch as he could not be on piece work when not in the shop, he was docked for tardiness according to the following schedule:

Arriving time	Deduction
7:01 to 7:15	1/2 hour's pay
7:16 to 7:30	3/4 hour's pay
7:31 to 7:45	1 hour's pay
7:46 and later	Two minutes time for each minute late

Despite these fines, which entailed considerable extra labor in the timekeeping office, there seemed to be no improvement in attendance. The machine department, for instance, with approximately one hundred men, had fifty-four men late in one week. During this week, which was typical of the usual attendance, eighteen men were late on Monday, while only six were late on Thursday.

Men coming to work late frequently remained until closing time in order to turn out their day's work, or if they did not complete their quota, they simply left it over for the next day, and thus slowed down production in the next department, as the plant was operated with no intermediate reserve stock rooms.

Computing the fines for a typical week in the machine department alone, it appeared that the men paid, on the average, over forty dollars for the privilege of coming to work late, while the plant expended more than thrice that amount on needless over-time for the cleaning gang, power and light wasted at machines through absence of men, and time lost in the assembly work farther down the line.

Finally, a promptness bonus was tried, and this has worked out very satisfactorily. Any man who is on time for an entire week receives a bonus of one-third hour's pay at his base rate. The second week, instead of being given the usual white time card, he receives a pink one; and if this, too, comes in with a clear attendance record, his bonus is doubled, giving him forty minutes' extra pay. The third week and thereafter he receives a blue card, which, so long as his record is perfect, entitles him to an extra hour's pay. Failure to report promptly on any day, however, automatically sends the man back to the white card rating from which he has an opportunity to work up as before.

Three months after the plan was put into effect 85 per cent of the cards on the time boards were blue and 9 per cent pink. The other 6 per cent represented replacements that were practically inevitable. Use of the promptness bonus system released one full-time and one part-time clerk from duty in the timekeeper's office. The men are now saving over 90 per cent of the money that they formerly lost through fines, and, on the average, gain nearly an hour's pay, while the company has practically eliminated over-time in all departments. The clean-up gang can go home promptly at the end of its regular working hours, and the management can count on practically 100 per cent production from the minute the whistle blows. The card system gave a further incentive to prompt attendance when the company decided to give each man in the shop one week's vacation with pay, provided he had not received more than four white cards during the year.

* * *

FIFTIETH ANNIVERSARY OF THE A. S. M. E.

The complete program for the Fiftieth Anniversary celebration of the American Society of Mechanical Engineers covers events in New York City, the headquarters of the Society; in Hoboken, N. J., its birthplace; and in Washington, D. C., in accord with the national character of the Society's work. The celebration begins in New York with the unveiling of a memorial tablet commemorating the Fiftieth Anniversary on April 5; it continues in Washington, April 7, 8, and 9.

Perhaps the most significant feature of the celebration will be the presentation of a series of sixteen papers, each summarizing the influence of engineering on civilization. Each paper will deal with the engineer's place in one of sixteen selected geographical divisions of the world. The authors of these papers are among the most distinguished engineers of the world.

In addition to the sessions commemorating the Fiftieth Anniversary, there will be a reception at the White House. During the meeting, the announcement of the first presentation of the Herbert Hoover Medal by the Hoover Medal Board will be made; the Board represents the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers. In addition, medals awarded through the American Society of Mechanical Engineers will be presented—the A. S. M. E. Medal to William L. Emmet; the Melville Medal, to Joseph W. Roe; the Gantt Medal to Fred J. Miller; and the Guggenheim Medal, to Orville Wright.

Current Editorial Comment

In the Machine-building and Kindred Industries

WHY ARE OBSOLETE MACHINES USED?

An investigation relating to the use of obsolete machines was made recently by the Bureau of Foreign and Domestic Commerce. It was found that in many industrial plants in the United States machines are used that are entirely unsuited for the purposes for which they are employed. They produce neither the quantity nor the quality of work that modern equipment is capable of producing.

This is not news to those familiar with the equipment of industrial plants in general; but a very important point was brought out in this investigation. In many instances, the fact that the machines and methods used are obsolete is not realized either by the management of the plant or by the operators of the machines. Quite frequently it was found that the management thought that the shop was provided with good equipment—in some cases the best equipment available—when, as a matter of fact, it was ten years or more behind the times.

This is a serious condition. It is bad enough when a shop is equipped with machines that are so old and inefficient that their operation places their owner at a disadvantage in the competitive struggle; but it is a great deal worse when this condition is not understood by those responsible for the output of the shop.

* * *

AN ACCURATE COST SYSTEM PROMOTES STABILITY IN THE INDUSTRY

At a recent meeting of manufacturers, the importance of an accurate cost system was emphasized. It was pointed out that unless a manufacturer knows his costs he cannot establish a selling price that will give him a reasonable return on his investment. Not only will he, himself, suffer, but he will demoralize the entire industry group to which he belongs.

One of the manufacturers took exception to this point of view. While he admitted that it was valuable to know one's costs accurately if every other manufacturer in the field also knew his, he maintained that so long as there are some manufacturers who sell below cost, it is not of much value to the others to know their costs, because they have to set their selling price on a competitive basis, irrespective of costs.

Unfortunately, this is so; but it is also a fact that it is easier to convince a man who knows his costs that he should not sell at a loss than it is to persuade him not to demoralize the market when he does not know what his product costs him. The manufacturers in each industry group must gradually be persuaded to adopt some form of cost system that will make it possible to determine fair selling prices. Such a program cannot be carried through at once, but gradually most manufacturers are recognizing the importance not only of a cost system, but of a uniform cost system for the industry group as a whole.

* * *

NEW IDEAS FOR MACHINE DESIGNERS

By studying mechanisms and machines used in industries other than the one in which he is engaged, the engineer or designer often obtains ideas that solve some problem confronting him. Too frequently the machine designer confines himself almost entirely to his own branch of the industry, with the result that his outlook is narrow and his knowledge and experience limited.

As an illustration of how methods used in one industry may be applied in a very different field, Mr. Bain, vice-president in charge of engineering of MacDonald Brothers, Inc., Boston, Mass., mentions the following experience: A manufacturer of small metal containers was required to complete the metal-working operations by coating the sheet-steel shell with a rustproofing compound. He had been unable to find an efficient means of doing this work, although many different methods had been tried. One day he visited a candy factory not a mile distant from his own plant, where, to his surprise, he saw a machine in operation that, with a few slight changes, could be adapted to his problem. This machine was used for coating machine-made candy with chocolate; but why not apply the same principles of operation to coating a metal shell with a rustproofing compound?

According to Mr. Bain, many similar cases could be cited where designers have been able to adapt methods used in other industries to their own needs.

* * *

SMOOTH FINISH OF FLUTES IN TOOLS

A production engineer tells us that he has found that a smooth finish—almost a polish—in the flutes of metal-cutting tools, such as drills, reamers, and taps is of great value. Polished flutes are of especial importance in drilling brass, aluminum, and cast iron, and also in deep-hole drilling, because the chips pass out of the drilled hole more easily. It is not so important to have a polished flute for drilling steel, as the steel chips themselves tend to polish the surface of the drill flute. Experiments have also shown that specially designed drills are of advantage for unusual requirements and that faster drilling can be done by using drills with a spiral lead suited to the material being drilled.

A Scientific Basis for Business Forecasts

A Method by which it Has Been Found Possible to Predict Business Conditions and to Make Reliable Business Forecasts

By ALVAN T. SIMONDS, President, Simonds Saw & Steel Co.

THE test of a science is its ability to predict future events accurately, and by this criterion the relation between economic factors and the major ups and downs of business is gradually being reduced to a science. Has not the science of economics as applied to business now reached such a development that we should cease to be interested in the opinions or guesses of outstanding business leaders regarding the future course of business unless they are based upon economic facts and principles clearly stated?

Reo Home Portraits

Alvan T. Simonds, President Simonds Saw & Steel Co.

It is a fact that in the months and weeks immediately preceding crises—as in 1920 and 1929—only a very small percentage of business leaders have been right, judging by their published statements, in their forecasts of what was just ahead in business and in the stock market. Yet their comments on the situation have been sought and widely published. As these opinions and guesses are so often wrong and misleading, they cause what might have been avoidable losses to those who follow them blindly. Are the chief executives of great corporations justified at such a time in publishing *guesses* or *opinions?* Should not such men be qualified, if they advise the public, to speak scientifically from their own study or from the investigations of others? Is it possible that a number of such outstanding business leaders would purposely mislead the crowd for personal gain? There are those who find this easy to believe. From the speeches in Congress, it would seem that some congressmen may possibly share this belief.

Scientific Economic Data Must be Substituted for Guesses

However this may be, it seems evident that we should give little or no consideration to opinions and guesses of leaders of business or of those engaged in speculation, or to opinions or guesses of professional business forecasters. Let us study only such statements regarding the future of business as are arrived at scientifically. This does not mean with the accuracy of perfected science; it means statements arrived at by the scientific method and in the scientific spirit and attitude. It means conclusions based upon the study of apposite data. It means suspended judgment until the conclusions are clear. It means the formulation of these conclusions by a mind free from emotional influences or selfish interest. In the case of statements as to the trend of future business, it assumes a knowledge of the workings of economic law. One who is ignorant of this can only have opinions or make guesses as to the future trend of business. To be sure, he may know what is immediately ahead of his particular industrial organization, perhaps because of unfilled orders on the books or of orders of which he is assured. In a similar way and for similar reasons, an association officer may know approximately what is immediately ahead of a particular industry as a whole.

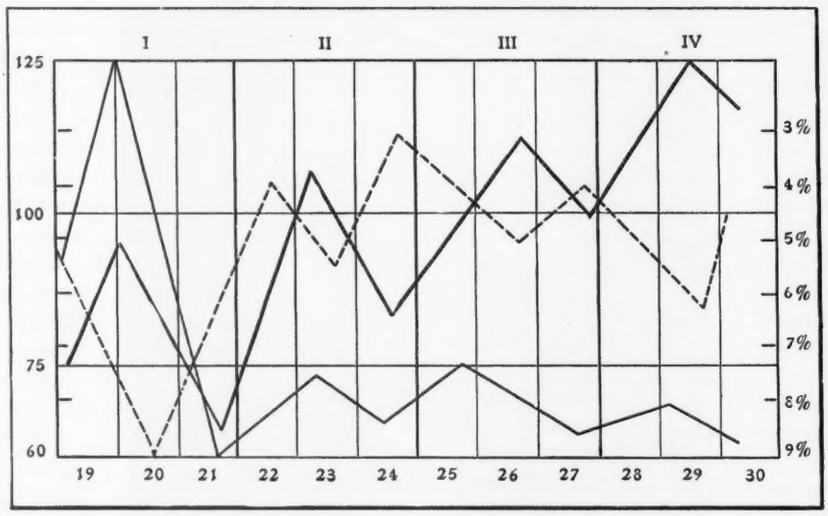
We are speaking here and now of those business executives who inform all who are interested just what is ahead of industry and business as a whole. Such men should be experts in economics and statistics or rely upon experts. They should let economic factors and relations do their forecasting for them. Even then, they should expect only approximate accuracy, not because of the failure of economic law, but because of the limitations of the one who interprets and applies the law. We cannot predict future business as accurately as we predict coming eclipses, but because the prediction of a re-

cent eclipse was not exactly accurate, we do not take recourse to guessing or having opinions as to when the next eclipse will occur. Instead of this, scientists go to work to discover just what was wrong in their scientific data and principles and to correct it, so that future eclipses will be predicted with accuracy.

This is Not an Appropriate Time for Mere Opinions

One of the greatest services that business organizations and the business press can perform just now would be to refuse to broadcast or publish opinions or guesses as to the immediate future of business, by whomsoever made. We are flooded with such statements at the beginning of each calendar year. This is ordinarily about the worst possible time to guess or to express an opinion, for changing major swings in business know nothing of January 1 or of the calendar year. There are, of course, seasonal minor swings which we adjust when studying major movements. Major swings must be considered in relation to the cycle that extends from valley to valley or from peak to peak.

As an illustration of the fact that it is possible today to discover economic factors that will forecast business correctly for two years ahead, I am quoting the following from the *Chicago Tribune*, January 16, 1929: "Alvan T. Simonds of Fitchburg, Mass., today predicted a slump in business throughout the nation beginning at the end of this year and to continue throughout 1930."



Climbing Cycles of Industrial Production. The Heavy Solid Line is Volume of Industrial Production; 100 is the Daily Average Production During the Years 1923, 1924, and 1925. The Chart Shows only Major Movements. (See Federal Reserve Bulletin, February, 1927, and Current Issues for Detailed Data.) The Dotted Line is Commercial Paper Rates, New York City, (Percentages Given to the Right). The Light Solid Line Represents Wholesale Commodity Prices

This clipping reached me exactly a year later on January 16, 1930, from a gentleman in Minneapolis who had kept it in his files for a year, perhaps with the intention, or at least the hope, of confounding me by sending it to me a year later. It is very likely that he would have been able to have done this if my forecast had been merely a guess or an opinion.

Many years ago, in reading Bishop Berkeley, I came upon the sentence, "Few men think but all have opinions." I have never forgotten this statement, and ever since have made it a rule to express opinions as seldom as possible; and if an opinion is demanded of me, to state clearly that it is simply an opinion.

Factors Affecting the Rise or Fall in Production

Back in 1919, as money rates continued to rise, I held the opinion that such a rise would *soon* bring about a decline in business. In stating this opinion and in discussing it with others, I found it difficult to explain what I meant by "business" and to find any data such as bank debits or prices, the curve of which I was willing to accept as the curve of "business." I did find data for the volume of manufacture, and in attempting to prove that my opinion as just stated was correct, substituted the volume of manufacture for "business." I was also obliged to eliminate the word "soon" from my opinion, because the turndown in "business" in 1920 did not come until about a year after the turnup in money rates. From that time in 1919 on, I have studied carefully the relation between major movements in money rates and major movements in the volume of manufacture or industrial production. I found that "money rates" were too indefinite and discovered that "commercial paper rates" in New York were definite and would serve as a forecaster. I discovered also that we might use acceptance rates or Federal Reserve rediscount rates. The latter, however, were not as sensitive as commercial paper rates, and commercial paper rates seemed to be but little affected by speculation — and only indirectly. The result of attempting to change my opinion into a scientific statement has been the production of the accompanying forecasting chart.

I had proved that my opinion as to the effect of increasing money rates upon the trend of business was correct, but learned to my surprise that this effect was not shown in a major turndown in the curve of business until many months later. Business or industrial production in the United States is of such magnitude that when it gets going in a certain direction up or down, it requires tremendous force applied for a considerable time to bring it to a dead stop and then set it going in an opposite direction. The greater the force applied, the quicker the stop. This was illustrated in 1914. The same thing is true of decreasing money rates and their opposite effect on business and production.

The fact that with changing money rates we do not have almost at once a changing trend in pro-

duction, did not seem to find ready acceptance. This conclusion is based upon constantly reiterated statements which ignore the lag between the two factors. The fact that the lag between the two factors varied from nine to eighteen months seemed even more difficult for others to believe. Our company began to publish in our house organ, the *Guide for Mill Men*, a statement of what money rates showed was ahead in production. The demand for this statement from those who were not mill men became so large that we are publishing it in leaflet form every other month. It is sent free to those who are interested, in the hope that it may help in a small way to increase the general economic intelligence which has been in evidence, particularly in the last few years.

The Prospects for the Immediate Future, Based on Ascertainable Data

At this writing, money rates have been decreasing since November, 1929, and the volume of industrial production has not yet begun to increase. The usual lag between the factors is taking place. Each month has shown a falling off, although, when complete statistics are available, it may be possible that February production will be shown to be slightly above that of January, and March is likely to be above February. This will not indicate, however, a major upward turn in production. It is a seasonal increase, likely to show a considerable rise in March and April; the low point of the present decline will probably come some time in the latter half of 1930, but this cyclical low point may not be much lower than the present low point. These statements are not merely opinions. They are what the forecaster clearly indicates.

Each major movement in business since the war has been accurately forecast by major movements in commercial paper rates, New York City. The present movement of commercial paper rates is downward to lower rates (shown on the chart *reversed*). If the sequences that have occurred since the war continue to occur through 1930 and 1931, we shall have an upward movement in production, beginning in the latter half of 1930 and continuing to a peak in the first half of 1932. At the present writing, the forecasting factors show only part of this rising movement, but they do show definitely that there will be a rising movement in production and a movement of rising prices beginning some time in the second half of 1930 and continuing well into 1931. Rising prices may begin somewhat earlier.

This forecast will prove true, if the correlations since the war are continued in 1930 and 1931. There are other forecasting factors that show the course of production for two or three months ahead. These will give warning if the correlations are not to continue. Great disasters cannot be forecast. If they could, some of them might be avoided. War ordinarily can be forecast only as possible or likely some time in the indefinite future. Great disaster or war would upset all forecasts.

* * *

SOUND PICTURES IN SALES PROMOTION

Portable photophone projectors are to be installed in each of the ten district offices of the General Electric Co. Through the medium of the photophone, or sound-motion pictures, salesmen and customers will see the latest developments in apparatus and hear descriptions of processes and methods of application by the persons best fitted to describe them. The customer will have an opportunity to see the actual building of the apparatus, and listen to a carefully prepared description by the engineer, the scientist, or the salesman; and officials of the company may address the district office employes.

The portable equipment consists of three units—the projector, the power amplifier, and the loud speaker. Each unit weighs approximately 100 pounds, and is about 25 inches square and 10 inches thick. The projector is of standard motion picture projector parts and utilizes standard film. The photophone carries the sound track on the film parallel to the picture, so that picture and sound are synchronously produced. The projector unit is completely housed in celotex, to deaden the noise of moving parts, particularly when used in a small room.

The portable projector may be operated successfully 90 feet from the screen, but gives its best performance at from 30 to 70 feet. Where it is necessary to use the outfit in smaller rooms, the picture may be projected behind the screen at a distance of 12 feet. In this case, a special film must be made with the sound track on the left side.

Designing Dies for Deep Cups

The designing of dies for deep cup forming—such as grease cups and similar shapes—and the use of coning dies which increases the thickness of the wall of the cup at desired points will be dealt with in an article in May MACHINERY. Shells of this kind often tend to crack or pull apart long before the desired depth is obtained. In view of these commonly experienced difficulties, many die designers would consider it practically impossible to design a set of dies to produce some of the unusual shapes that will be shown in this article. Complete descriptions, with illustrations, will be given of dies that have been employed successfully in producing the shapes required.

* * *

The Bureau of Standards recently proposed the use of a coating of pure aluminum as a protective material for duralumin, now largely used in aircraft construction. The lightness of duralumin made it a most valuable material in the airplane industry, but the corrosion caused by certain weather conditions limits its application. The coating of pure aluminum has proved quite satisfactory. Even in cases where this coating had been attacked, the coated duralumin was found to be more durable than duralumin alone. Furthermore, the coating withstood 100,000,000 alternations of stresses in tests made by the Bureau of Standards. The coated duralumin is now being produced commercially.

Modern Management in the Jobbing Shop

Advantages of Systematically Organized Leadership, as Compared with an Inadequate Force of Overburdened Executives

By ARTHUR MUMPER

THE purpose of this article is to point out how principles of scientific management, applied to the general run of jobbing shops, will increase production, reduce scrap, and lessen the mental strain on the executives. The last item is by no means an unimportant one. A more uniform flow of work through the shop will also result from a properly applied system. The information in this article is not guesswork, but is based on the experience of the writer while serving as general foreman in several jobbing shops.

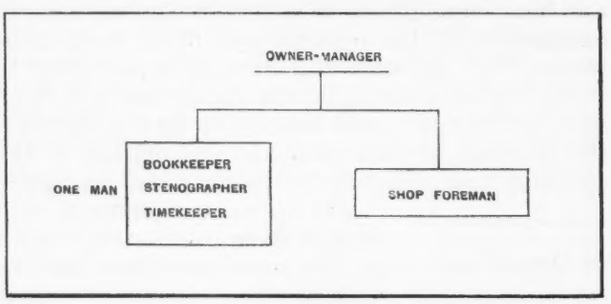


Fig. 1. Organization Chart of Small Shop where Manager and Foreman are Overburdened with Detail Work

Fig. 1 shows how too many jobbing shops are organized. First, there is the owner-manager, who is the head of the business and usually does the work of three or four men. Next in importance, and directly responsible to the manager, is the shop foreman. Then comes the man in the office, who is bookkeeper, stenographer, and timekeeper all in one. Sometimes this part of the business is handled by two girls, but in either case, the responsibilities of the manager and the foreman are not lessened.

The manager tries to make all important telephone calls, answer any letters that require his attention, quote prices on new work, make hurried calls to various parts of the city where business demands his personal attention, look over requisitions for material and supplies, interview salesmen, solicit new business, check up on the work done in the shop the previous day, and devote his spare time to the relief of the overburdened foreman. Thus, we see that the owner-manager has quite a large number of routine duties.

Now the owner-manager of a jobbing shop employing, say, thirty men, should be rated fairly high as far as salary goes, for he is the head of a business which may amount to about $125,000 annually. During exceptionally good years, the actual business of a concern of this size may be as high as $180,000. Hence, it would seem that the manager of such a business would be too valuable a man to attend to any but strictly managerial duties. Obviously, he should leave the minor details to a superintendent, who would fit in between the foreman and the manager.

It appears to the writer that the managers of many jobbing shops hold the need for curtailing overhead expense so close to their eyes that they cannot see the dollars to be saved by employing a superintendent. They fail to see that increased production and a decrease in the amount of scrap, made possible by employing a superintendent, will pay the additional salary and at the same time add many dollars to the earnings of the concern. An overburdened foreman cannot give his men the proper supervision, and he has little time to devote to the reclaiming of spoiled work and scrap material. The superintendent, however, makes it possible for the foreman to give more attention to such matters.

Referring to the chart Fig. 1, it is obvious that the foreman must take care of all the executive work that cannot be handled by the manager. In shops of this kind, the foreman must set the date of delivery on new work, make out material requisitions for the various jobs, do considerable designing, plan the work for his thirty men, and see that the material and blueprints are at the proper place and so arranged that any man or any number of men can take up the work when they are finished with their present jobs.

The foreman must also see that every man is kept busy and he must give each man individual attention as needed, plan the work for the night shift, see that the men understand the blueprints, and with the inspector's assistance, decide what is to be done about any mistakes or errors that may have been made. After going over his shop work thoroughly, the foreman must use what time he

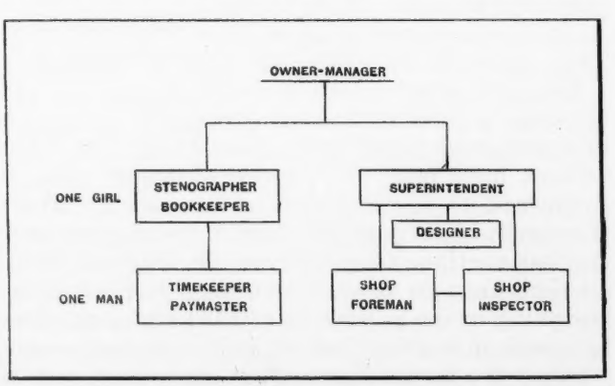


Fig. 2. Chart Showing Properly Organized Executive Force for Small Jobbing Shop

has left to assume as much of the manager's detail work as possible. Under these conditions, the foreman has no time to study the shop requirements, with the object of making needed or desirable improvements.

There should be an assistant foreman in plants of the size considered here, but the management seldom feels justified in paying enough for this job to make it attractive, considering the great amount of detail work involved. A good toolmaker, if qualified for this position, can make about as much money at the bench, where he has no responsibility aside from his own individual work.

The chart Fig. 2 shows a carefully worked-out system of management for the average jobbing shop employing about thirty men. This system includes a sufficient number of people to enable the managerial work to be handled efficiently. In this case, the superintendent quotes prices, orders materials, supervises the designers' work, goes over the shop inspectors' reports, and makes decisions, concerning errors and mistakes.

He also acts as a buffer between the foreman and manager, settling all matters that do not require the manager's attention and interviewing salesmen. It is also his duty to see that no one reaches the manager's office who has business that he can handle himself. The superintendent, in a large measure, directs the work of the office force and decides the order in which jobs are to be started in the shop and also what materials are to be used where no specifications are given.

The inspector is not responsible to the foreman, but to the superintendent. The designer, who is also responsible to the superintendent, makes all drawings, thus relieving both the manager and the foreman of this work. In Fig. 2, the square enclosure representing the position of the shop foreman, is tied to that of the shop inspector by a line simply to indicate that the two men occupying these positions must work in close cooperation. Thus, relieved of work which formerly required about 30 per cent of his time, the foreman is enabled to exercise efficient supervision over the shop.

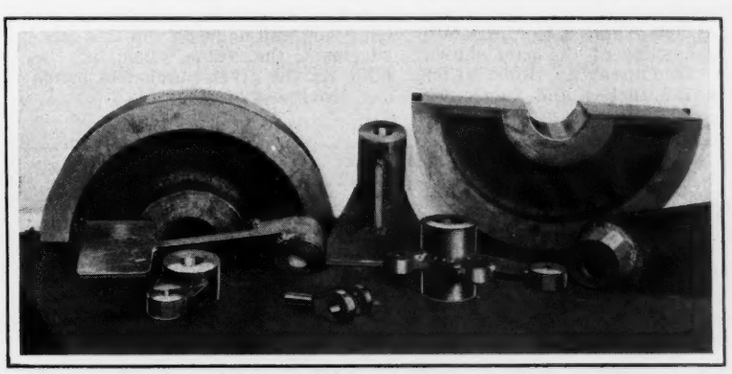


Fig. 2. Arc-welded Parts of Brake System Applied to Car Shown in Fig. 1

ARC-WELDED TRANSFER CAR

The storage battery type of transfer car shown in Fig. 1 is a good example of arc-welding applied to the building of special shop equipment. The frame of the transfer car was built from rolled I-beams and steel plates of odd lengths and sizes which were classed as scrap material.

Some of the parts for the brake installed on the transfer car are shown in Fig. 2. These parts are made up from steel plates and odds and ends of round stock. This method of construction eliminated the necessity for making patterns or castings of any kind. Another feature of this construction is that practically no machining is required. The car and parts illustrated were made at the East Pittsburgh works of the Westinghouse Electric & Mfg. Co.

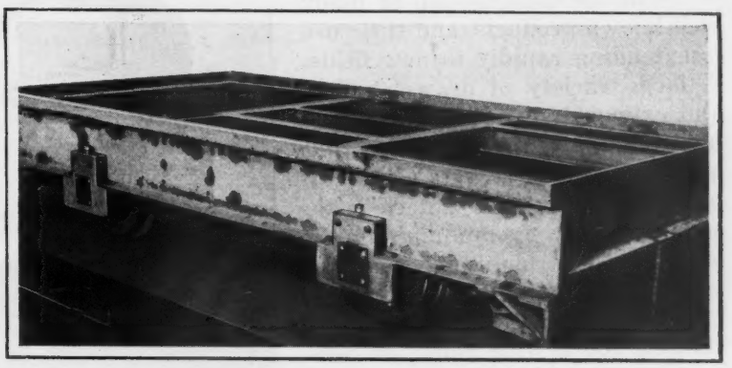


Fig. 1. Transfer Car Constructed from Scrap Material by Arc Welding

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JIGS FOR PRODUCTION WELDING

Jigs are now used extensively to obtain economy and speed in performing electric or gas welding operations and to produce a uniform or standardized product. A good welding jig should (1) hold the work pieces positively in position; (2) be made so that the work can be quickly inserted and removed; (3) make impossible the insertion of the work-piece in any but the correct position; (4) provide devices for rapid and steady clamping and adjusting without undue effort; (5) allow no spring in the work-piece from clamping operations; (6) allow no buckling, warpage, or other distortion from expansion or contraction due to the heat of the blowpipe; (7) permit inspection of the weld if necessary; (8) be easily cleaned and have faces that will hold the work without marring it; (9) be as light as is consistent with the rigidity and strength necessary in such equipment; (10) be easy to handle and not unwieldy; (11) be safe under any and all circumstances; (12) by its construction or location, permit the welder to work without undue inconvenience or unnecessary fatigue; (13) be movable, if possible, so that all welds can be made in a horizontal position.

Data for Designing Sheet-Aluminum Parts

Tables of Bending Allowances and Shearing Strength of Screw Threads for Use in Fabricating Parts from Aluminum Alloy Sheets

By K. GEORGE SELANDER

ALUMINUM and aluminum alloys are employed extensively in the construction of many well-known products, and their use is extending rapidly to new fields. A large variety of drawn, rolled, and extruded shapes or forms are now obtainable in aluminum and aluminum alloys. There are many parts, however, that can be made advantageously from aluminum alloy sheets by blanking, bending, and forming operations.

A material of this kind, which is suitable for a wide range of products, is the 51-S aluminum alloy made by the Aluminum Co. of America. This material is very strong, and is used extensively in the manufacture of furniture, where strength combined with lightness is particularly desirable. The general physical properties are: Specific gravity, 2.69; weight per cubic inch, 0.098 pound; and weight per cubic foot, 169 pounds.

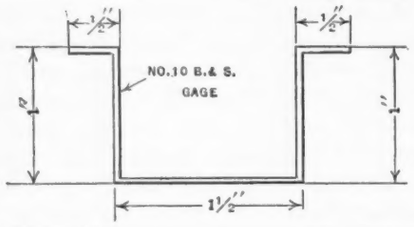
K. George Selander

This metal is furnished in four different states or conditions. The soft state is designated as 51-SO; the "quench" temper, 51-SW; the heat-treated or "aged" temper, 51-ST; and the hard alloy (as extruded), 51-SH. The 51-SW material is suitable for many purposes and is used extensively for metal furniture. Its tensile strength is from 30,000 to 40,000 pounds per square inch; yield point, from 15,000 to 20,000 pounds per square inch; and elongation in 2 inches, from 20 to 30 per cent. The Brinell hardness number, using a test ball 10 millimeters in diameter and a pressure of 500 kilograms, is from 55 to 70.

The tables accompanying this article apply to the 51-SW metal. Table 1 has been prepared to enable the draftsman to determine quickly the size of blank required to produce a bent or formed part,

K. George Selander was born of Swedish parents in Finland in 1877. He received his education in Sweden and came to the United States in 1898. After working here for some time in the mechanical industries, he became chief draftsman for the Art Metal Construction Co., Jamestown, N. Y., in 1917, and held a similar position with the O. M. Edward Co., Syracuse, N. Y., in 1919. Later he was employed as tool draftsman and checker by the Franklin Automobile Co. in Syracuse, and subsequently became chief engineer and superintendent of the Metal Goods Corporation in Buffalo, N. Y. In 1925, he was engaged as chief designer for the U. S. Aluminum Co., Pittsburgh, Pa., at the company's fabricating division in Buffalo.

Table 1. Values for Obtaining Blank Sizes for Formed Aluminum Parts

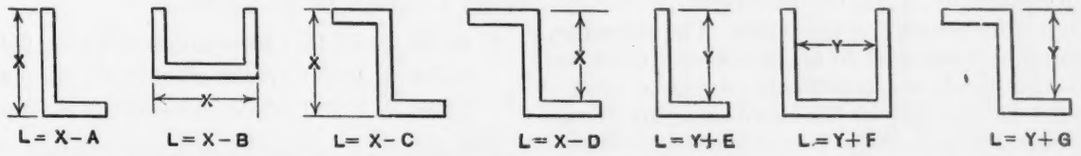


This table contains the values to be deducted from the total outside dimensions of a bent or formed part made from aluminum alloy sheet stock. If, for example, the total outside dimensions of the part shown in the accompanying illustration equal 4 1/2 inches and there are four bends, the length of the blank would be 4.5 — 0.696 = 3.804 inches.

Thus, it is simply necessary to measure around the outside of the bent part and deduct from this measurement the value given in the table for the given number of bends and thickness of stock.

	Thickness											
B. & S. Gage	10	11	12	13	14	15	16	17	18	20	22	24
Inch	0.1019	0.0907	0.0808	0.0720	0.0641	0.0571	0.0508	0.0453	0.0403	0.0320	0.0253	0.0201
No. of Bends	Values to Be Deducted from "Outside" Dimensions, Inches											
1	0.174	0.154	0.138	0.122	0.109	0.098	0.088	0.077	0.068	0.054	0.043	0.034
2	0.348	0.308	0.276	0.244	0.218	0.196	0.176	0.154	0.136	0.108	0.086	0.068
3	0.522	0.462	0.414	0.366	0.327	0.294	0.264	0.231	0.204	0.162	0.129	0.102
4	0.696	0.616	0.552	0.488	0.436	0.392	0.352	0.308	0.272	0.216	0.172	0.136
5	0.870	0.770	0.690	0.610	0.545	0.490	0.440	0.385	0.340	0.270	0.215	0.170
6	1.044	0.924	0.828	0.732	0.654	0.588	0.528	0.462	0.408	0.324	0.258	0.204
7	1.218	1.078	0.966	0.854	0.763	0.686	0.616	0.539	0.476	0.378	0.301	0.238
8	1.392	1.232	1.104	0.976	0.872	0.784	0.704	0.616	0.544	0.432	0.344	0.272
9	1.566	1.386	1.242	1.098	0.981	0.882	0.792	0.693	0.612	0.486	0.378	0.306
10	1.74	1.54	1.38	1.22	1.09	0.980	0.880	0.770	0.680	0.540	0.430	0.340

Table 2. Values for Obtaining Lay-out Dimensions for Aluminum Blanks



X = outside dimension of cross-section of a part to be formed from sheet stock;

L = lay-out dimension for determining length of blank or flat stock required to give finished dimension X for bent part or distance from end of stock to the point where bend is made;

A = amount to be subtracted from X to give required lay-out dimension L, where there is one right-angle bend;

B = amount to be subtracted from X to obtain lay-out dimension L where there are two right-angle bends, as indicated in the corresponding diagram;

C = amount to be subtracted from X when there are two right-angle bends in opposite directions;

D = amount to be subtracted from X to obtain L when outside measurement X is as indicated in the diagram;

Y = inside dimension of cross-section of part to be formed;

E = amount to be added to inside dimension Y to obtain lay-out dimension L for blank when there is one right-angle bend;

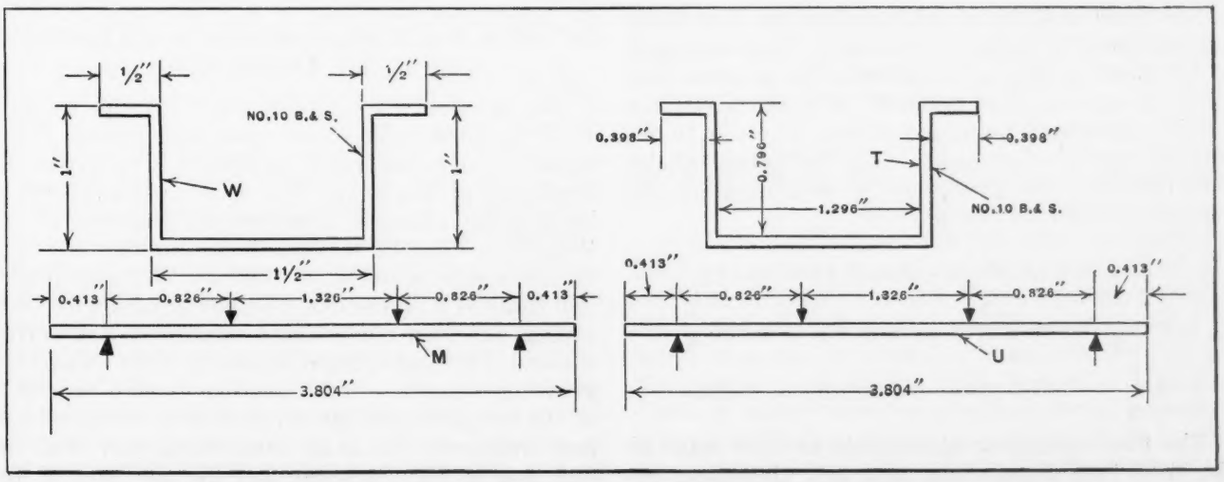
F = amount to be added to Y to obtain lay-out dimension L when there are two right-angle bends;

G = amount to be added to Y when there are two right-angle bends in opposite directions.

Thickness, B. & S. Gage	Thickness, Inch	Weight per Square Inch, Pounds	Weight per Square Foot, Pounds	Values to be Subtracted from Outside Measurements X to Obtain Lay-out Dimensions for Aluminum Blanks				Values to be Added to the Inside Measurements Y to Obtain Lay-out Dimensions for Aluminum Blanks		
				A	B	C	D	E	F	G
10	0.1019	0.0100	1.44	0.087	0.174	0.174	0.072	0.0150	0.030	0.030
11	0.0907	0.0088	1.28	0.077	0.154	0.154	0.063	0.0140	0.028	0.028
12	0.0808	0.0079	1.14	0.069	0.138	0.138	0.057	0.0120	0.024	0.024
13	0.0720	0.0070	1.01	0.061	0.122	0.122	0.050	0.0110	0.022	0.022
14	0.0641	0.0062	0.903	0.054	0.109	0.109	0.045	0.0095	0.019	0.019
15	0.0571	0.0055	0.804	0.049	0.098	0.098	0.041	0.0080	0.016	0.016
16	0.0508	0.0049	0.716	0.044	0.088	0.088	0.037	0.0070	0.014	0.014
17	0.0453	0.0044	0.638	0.039	0.077	0.077	0.032	0.0065	0.013	0.013
18	0.0403	0.0039	0.568	0.034	0.068	0.068	0.028	0.0060	0.012	0.012
20	0.0320	0.0031	0.450	0.027	0.054	0.054	0.022	0.0050	0.010	0.010
22	0.0253	0.0024	0.357	0.022	0.043	0.043	0.018	0.0035	0.007	0.007
24	0.0201	0.0019	0.283	0.017	0.034	0.034	0.014	0.0030	0.006	0.006

such as the one shown in the upper left-hand corner of the table. It is assumed that the bends are made in an ordinary V-die mounted in a power press. As illustrated by the example accompanying the table, the method consists of adding together the outside dimensions of the cross-section of the part and deducting from the sum the amount given in the table. This method has proved very accurate in practice.

Table 2 has been prepared for the convenience of the designer or draftsman who lays out the work and the dies for the cutting and bending operations. Provision is made in this table for employing either outside or inside dimensions for calculating the length of material required to form the part. In the diagrams, the dimensions indicated by X are outside dimensions, and those indicated by Y are inside dimensions. The first four columns in Table 2 give, respectively, the thickness of the material according to the Brown & Sharpe gage; the equivalent thickness in inches; the weight per square inch in pounds; and the weight per square foot in pounds.



Lay-outs for Blanks of Formed Aluminum Parts, Used in Connection with Table 2

The columns headed *A* to *D*, inclusive, give the amounts to be subtracted from the outside measurements indicated by *X* in the diagrams, to obtain the lay-out dimensions for the blank. The amounts in the columns headed *E* to *G*, inclusive, are to be added to the inside measurements indicated by *Y*.

The view at the left in the accompanying illustration indicates how Table 2 is employed to determine the location of the points at which the bends are to be made, and the total length of blank *M*

Table 3. Shearing Strength of Screw Threads in Aluminum Alloy Sheets*

Screw No. and Threads per Inch	Thickness of Sheet		Area in Shear, Square Inches	Total Load to Produce Shear, Pounds	Shearing Strength, Pounds per Square Inch
	B. & S. Gage	Inch			
8–32	20	0.0320	0.0155	198	12770
8–32	18	0.0403	0.0206	302	14660
8–32	16	0.0508	0.0273	374	13700
8–32	14	0.0641	0.0325	514	15920
8–32	12	0.0808	0.0407	580	14250
8–32	10	0.1019	0.0551	791	14360
10–32	20	0.0320	0.0179	301	16820
10–32	18	0.0403	0.0239	384	16020
10–32	16	0.0508	0.0316	555	17560
10–32	14	0.0641	0.0376	678	18030
10–32	12	0.0808	0.0472	893	18920
10–32	10	0.1019	0.0639	1140	17840
10–24	20	0.0320	0.0179	240	13410
10–24	18	0.0403	0.0239	303	12680
10–24	16	0.0508	0.0316	460	14560
10–24	14	0.0641	0.0376	540	14360
10–24	12	0.0808	0.0472	633	13410
10–24	10	0.1019	0.0639	1012	15840

*The figures in this table give the actual breaking stress as determined by tests. For safety under ordinary conditions, divide the shearing strength by 2. When the screws are subject to shock, divide the shearing strength by 3.

required to form the part *W* from No. 10 B & S stock. The length of the stock required for the 1/2-inch flange is found by subtracting the value given in column *A* for 10-gage stock. Thus, we have

$$\frac{1}{2} - 0.087 = 0.413 \text{ inch}$$

For the height dimension of 1 inch, the required length $L = X - C$, as indicated in the third diagram at the head of the table, would be

$$1 - 0.174 = 0.826 \text{ inch}$$

The remaining lay-out dimensions for the blank are obtained in a similar manner. The diagrams at the head of the table indicate the column that gives the amount to be deducted from the particular outside dimension being considered in order to obtain the lay-out dimension. The following tabulation indicates the procedure in obtaining all the lay-out dimensions for part *W*.

$$\frac{1}{2} - 0.087 \text{ (from column } A) = 0.413$$

$$1 - 0.174 \text{ (from column } C) = 0.826$$

$$1\frac{1}{2} - 0.174 \text{ (from column } B) = 1.326$$

The two remaining dimensions are the same as the first two dimensions, and are, therefore, repeated to complete the dimensioning of blank *M*.

In the case of the part *T*, where the inside dimensions are given, the procedure in dimensioning the blank *U* would be as follows:

$$0.398 + 0.015 \text{ (from column } E) = 0.413$$

$$0.796 + 0.030 \text{ (from column } G) = 0.826$$

$$1.296 + 0.030 \text{ (from column } F) = 1.326$$

The shearing strengths of screw threads of aluminum alloy sheets given in Table 3 were obtained from tests made in an Olsen testing machine. In making the tests, the rate at which the ram of the machine advanced was 0.1 inch per minute. This table is intended to serve as a guide in estimating the strength of screw thread fastenings in aluminum alloy sheet metal.

* * *

STEEL FOUNDERS' SOCIETY ADOPTS ARBITRATION CLAUSE

The Steel Founders' Society of America, Inc., 932 Graybar Building, New York City, which represents the steel casting plants of the country, has recommended to its members that an arbitration clause be incorporated in their purchase and sales contracts. At a meeting of the Board of Directors of the Society, recently held in Pittsburgh, it was voted, upon the recommendation of Granville P. Rogers, managing director, to enter into a cooperative arrangement with the American Arbitration Association, under which the latter's tribunal facilities would be available to all the Society's members.

The terms of the agreement entered into by the Society and the American Arbitration Association provide that the Society accept the arbitration rules of the Association and approve the following arbitration clause for such voluntary use as its members may desire: "Any controversy or claim arising out of or relating to this contract or the breach thereof shall be settled by arbitration, in accordance with the rules, then obtaining, of the American Arbitration Association, and judgment upon the award rendered may be entered in the highest court of the forum, state or federal, having jurisdiction."

* * *

GEUDER, PAESCHKE & FREY CO. CELEBRATES FIFTIETH ANNIVERSARY

The Geuder, Paeschke & Frey Co., Milwaukee, Wis., manufacturer of stamped and drawn sheet-metal articles, celebrated its fiftieth birthday at the beginning of this year. The occasion was observed by holding a Golden Anniversary Banquet at the Wisconsin Club in Milwaukee on January 27. The business was founded in 1880 by William Geuder and Charles A. Paeschke, two young men with little capital but with much vision, ambition, and enthusiasm. Two years later Frank J. Frey joined the growing concern. Mr. Paeschke is still president of the company and Mr. Frey is first vice-president and treasurer. It is an interesting fact that the only son of Mr. Paeschke and the only son of Mr. Frey are both vice-presidents of the company.

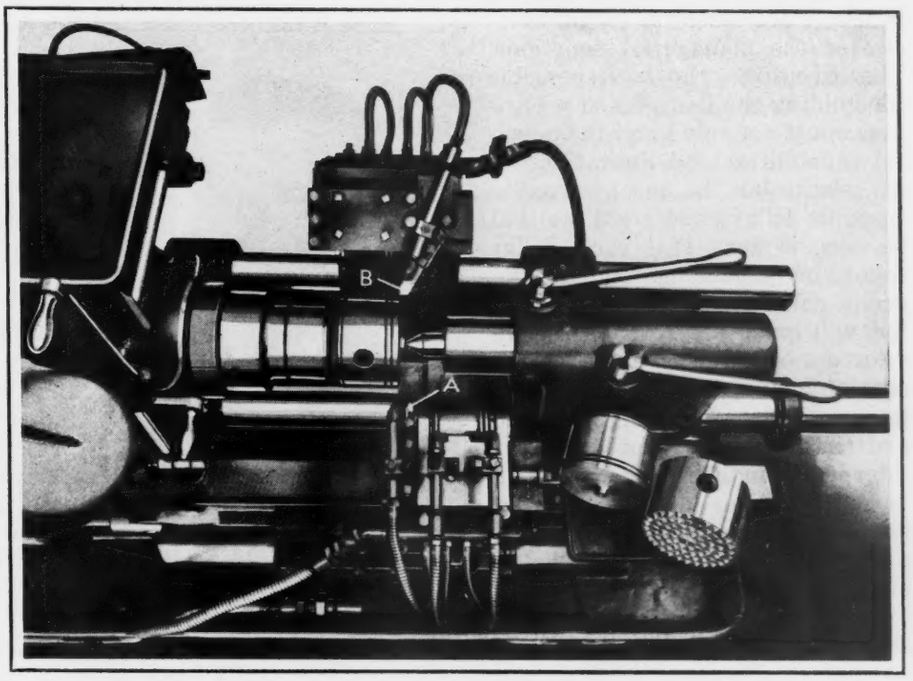
Rolling Grooves in Aluminum Pistons for Airplane Engines

By H. T. LAFFIN

In machining piston grooves, it has always been more or less of a problem to keep them to the required limits. A very satisfactory method has recently been devised in which the final grooving operation is performed by means of rolls instead of cutting tools, which results in a smoother and longer wearing surface. The work is done on a Fay automatic lathe, as shown in the accompanying illustration.

Previous to this rolling operation, the piston is rough-turned, rough-faced, rough-grooved, finish-faced on the open end, finish-bored, and the boss on the closed end centered. The center in the boss and the bore in the open end run true with the inside of the casting, thus insuring a uniform thickness of the piston wall after the outside is finished.

The piston is mounted on a spindle fixture, being located by the bore and against the face of the open end; the closed end is supported by means of a revolving, ball-bearing, tailstock center. The equalizing drive in this fixture acts against the wrist-pin bosses on the inside of the piston. The machine for performing this operation carries tools in the carriage for profile-turning the outside diameter, and a set of three rolls for finish-rolling the grooves. The back arm carries a tool for facing the closed end down to the supporting boss; also three knife-blade cutters for cutting the grooves, and a tool for chamfering the outside corner of the open end.



Set-up for Finishing Piston Grooves by Rolling in an Automatic Lathe

These knife-blade cutters are held in a magazine, together with spacers, hardened and ground to the exact width, which give proper spacing for the grooves. The magazine can readily be removed from the back arm, so that the tools can be reground in their original setting, or they can be taken out and replaced by another set. This replacement can be made on the bench, so that no adjustments are necessary after the magazine has been returned to the back arm on the machine.

As the machine passes through its cycle of operations, turning tool *A* in the carriage profile-turns the outside diameter, turning each land to size and allowing approximately 0.020 inch on the body of the piston for finish-grinding. While this tool is turning, tool *B* in the back arm is facing the end of the piston. After the finish-turning cut is completed, the grooving tools cut the grooves; then the rolls, which were brought into position while the grooving tools were cutting, finish-roll the grooves to size. While the finish rolls are in operation, the back arm grooving tools are held in position so that any burrs that might enter the grooves are cleaned out. This eliminates a separate cleaning or burring operation. In finishing the grooves as outlined, the variation of the width will not be more than 0.0005 inch.

The length of time taken for this operation is 41 seconds. Of this time, 21 seconds is required for profile-turning; 7 seconds, for grooving with back arm tools; 4 seconds, for rolling the grooves; 3 seconds, for dwell while the back arm grooving tools are cleaning the bottom of the grooves; and 6 seconds, for idle machine time.

* * *

MANAGEMENT AND MATERIALS HANDLING MEETINGS

A National Management Congress was held under the auspices of the American Society of Mechanical Engineers at the Hotel Stevens, Chicago, March 3 to 5. Among the sessions of especial interest was one devoted to "Readjustments of the Machine Age." A National Materials Handling Meeting, also under the auspices of the American Society of Mechanical Engineers, was held in Chicago, March 5 to 7. The papers dealt with material handling in a wide range of industrial plants.

Four Methods of Applying Overhead Cost

A Simple Explanation of the Machine-hour Rate Method for Estimating Overhead and its Application in the Machinery Industries

By LOUIS G. GOETZ, Manager, Factory System Department, Pace, Gore & McLaren (formerly Nau, Taylor & Swearingen), Cleveland, Ohio

IF the question were asked: "To what is the great advance in all the mechanical fields of human enterprise due?", the answer would be: To the acquiring of exact knowledge through research and experience, to the practical application of this knowledge, and to the interchange of ideas.

If it is true that exact knowledge and the ability to apply it are essential to the advancement of the mechanical side of industry, it is equally true that exact information and the knowledge of how best to use it are essential to the exercise of the managerial functions. The executive, who is responsible for guiding the destinies of a business, must not only know the physical capabilities and limitations of his plant, but he must visualize these in dollars and cents, so that he can be sure that each dollar spent in producing and selling goods will not only return intact, but will bring a return on the investment along with it. For the obtaining of this information, for its presentation in intelligible form, and (in some cases) for the proper interpretation of the data collected, most executives depend on that part of the organization usually designated as the cost department.

Louis G. Goetz

Why a Well Organized Cost Department is a Necessity

The information contained in adequate cost records is important, because it is essential in making accurate estimates, setting sales prices, determining what business shall be bid on, and what shall be passed by, and intelligently controlling expense.

Many executives feel that the expense of maintaining a cost department is, at best, a necessary evil, but, as a matter of fact, that department has definite functions to perform and is just as important in its sphere as any other part of an organization.

Competition is now so keen that each executive in charge of operations must know exactly where he stands when bids are submitted. He must cease guessing and deal with facts. If a price must be reduced in order to meet competition, he ought to know what element of his cost he expects to reduce and how much he expects to reduce it; for if he wishes to be conservative, he cannot reduce prices until he knows what he can afford to reduce, and how much. He must know whether the work on which he is asked to bid is such that his plant is suited to handle it efficiently; and, finally, he must be able to recognize that, in some cases, it is more profitable to lose the business than to get it at any price. The part of his organization that must present the facts to give the true dollar-and-cents answer to such questions, so that an intelligent decision can be made, is the cost department.

The Primary Elements of Costs

What then are the elements of cost? What is the information that the cost department in an industrial plant should be able to present? In what form should it be available, and how should it be used in compiling estimates?

The elements entering into manufacturing cost of any article are three, namely: (1) Raw material; (2) direct labor; (3) indirect expense, known as "burden" or "overhead."

By "raw material" is meant the material that is to be processed to produce the finished product. In the machine industry, this is usually steel, iron, brass, and bronze, in the shape of bars, forgings, sheets, or castings.

In considering this element, raw material must not be confused with "indirect expense materials" used as an incident to the manufacturing processes (cutting tools, oil, cotton waste, etc.), which disappear during these processes and cannot be identified as part of the finished product. Materials of this class are a part of "overhead," except in the case of special tools used for one job only. The cost of the latter is usually treated as an item separate and additional to the three elements mentioned.

LOUIS G. GOETZ was born in Greenville, Ohio, in 1883. He graduated from Wabash College with the degree of A. B. in 1907. Later he was employed by the St. Louis Steel Foundry and the Cincinnati Steel Castings Co. in the manufacture of steel by the Tropenas process. In 1912, he became financially interested in the American Lock Nut Co., and after having devoted some time to toolmaking and to the design and construction of special machinery, became plant manager and later secretary of the company. The concern was merged with another firm in 1918, and Mr. Goetz went to Cleveland as plant manager of the Adams-Bagnall Electric Co., now a part of the National Screw & Mfg. Co. In 1920 he became a member of the staff of Nau, Rusk & Swearingen and has been with this firm ever since. The company changed its name in 1925 to Nau, Taylor & Swearingen, and recently entered into the national partnership of Pace, Gore & McLaren, as the partner firm in Cleveland. Since 1925, Mr. Goetz has been the head of the systems department, and has specialized on cost, production, personnel, and organization problems.

In most cases, raw materials are bought outright like any other merchandise. The segregation of the invoice cost, plus transportation and handling charges, offers no difficult problem, and a unit value can be obtained for any manufactured article with comparative ease.

"Direct labor" is that which is performed during the manufacturing processes. Like raw material, it can be easily identified; for instance, the labor cost on each machining operation on a certain gear, or a number of like gears, can be recorded with comparative ease, and if any sort of production records are available to show the number of pieces completed, a dependable unit cost of direct labor can be obtained without difficulty. Hence, both the direct elements entering into the cost of an individual article—namely the raw material and direct labor costs—can be identified, segregated, and reduced to unit figures with little difficulty.

Recording Overhead Expense

It is when an effort is made to segregate and apply "indirect" or overhead expense that difficulties arise. The problem of apportioning overhead in either estimated or actual costs of a manufactured product, has long been a hard nut for managers to crack. This is especially true in cases where cost records are inadequate or lacking; even with such records, this element requires careful thought, because of its complex composition and its indirect relation to the product.

Manufacturing or factory overhead may be defined as the expense that is incurred in maintaining and operating the plant, but that is not directly applicable to the product, and that cannot be identified in, nor confined to, any one unit of the product. The following are some of the expenses of which it is composed: Shop supervision; salaries of factory clerks; experimental expense; non-productive factory labor; repairs to factory buildings and equipment; standard cutting tools; shop supplies; light; heat; power; water; liability insurance; depreciation on buildings and equipment; insurance on buildings and equipment; and real estate and personal taxes.

How Can Overhead be Accurately Apportioned to Each Unit of the Product?

How shall such diverse expenses composing one of the three essential elements be apportioned equitably to the cost of the product? How can assurance be had that each unit of production is going to bear its proper share of the overhead, and how shall the executive know whether enough is being applied to write into his costs the whole amount incurred? On what basis shall he apply it in his estimates, so that the true cost can be predetermined and a sales price quoted that will cover his costs and insure a return on the investment, particularly if the articles manufactured are of diverse nature? The answers to these questions have been found, but only through long and tedious development.

Earliest Methods of Applying Overhead

Before the underlying principles of cost engineering were generally understood and exact knowledge concerning them was acquired, it was customary, in making an estimate to proceed about as follows: First, the costs of labor and material were estimated as closely as possible; next, to the sum of these two was added a flat figure to cover overhead and return on investment. If the resulting figure was considered too high, it was reduced; if it looked too low, it was increased; but there was always uncertainty, and at the end of any period, the head of the business never knew which jobs had been profitable and which had not.

Later on, as more exact knowledge of the true nature of costs was gained and better methods of compiling them were developed, an endeavor to apply overhead was made by adding a certain per cent of the dollars and cents representing the direct labor to the combined cost of labor and material. In estimating by this method, it was necessary to know not only the amount of material and direct labor, but also the relation of the total overhead to the total direct labor over a given period.

Many executives seem to think that the expense of maintaining a cost department is, at best, a necessary evil, when as a matter of fact that department is just as important to the successful management of the business as any other part of the organization. Competition now is so keen that a manager of a plant must know definitely the relation between his costs and his selling price. He must cease guessing and deal with facts. He must be able to decide whether it is not more profitable at times to lose business than to get it at any price. The facts that he needs in making his decisions are based upon the information that a well organized cost department can furnish.

Improved Method of Estimating Overhead Expense

Still later, a certain percentage rate per hour of the direct labor cost was used. In following this method, it was necessary to know the cost of material, the cost of direct labor, the hours of labor, and the approximate overhead cost per hour of operating direct labor in the various departments throughout the plant. This overhead cost per hour of direct labor was obtained by breaking down the items of factory overhead into departments. A rate per hour was obtained by dividing into the departmental totals the average number of direct hours possible, under normal conditions, in the respective departments.

The methods described have served the purpose to some degree, and all three of them are still in use to some extent; but more exact knowledge and its practical application in the compiling of costs have produced more accurate methods.

A Still Further Improved Method of Apportioning Overhead

The most advanced knowledge concerning the nature of factory overhead expenses and their relation to the cost of a specialized product has led to the formulation of this rule: Overhead cost should be applied to the cost of the product in the same

proportion to the total overhead of the departments doing the work as the time consumed in processing the product bears to the total available productive time of the departments in which the processing is done. This principle is fundamental, and any method of applying overhead that disregards it does not result in true and accurate costs. This principle may be formulated as an equation, thus:

$$\frac{\text{Overhead to be applied}}{\text{Total Overhead}} = \frac{\text{Processing time}}{\text{Total available time}}$$

If x equals overhead to be applied, we have

$$x = \frac{\text{Processing time} \times \text{total overhead}}{\text{Total available time}}$$

Analysis of the Three Methods Mentioned

The first method of applying overhead which was described entirely disregards the principle just expressed and bases the distribution on the combined costs of the direct elements. By such a method two gears, for example, requiring the same amount of productive time in their manufacture, but containing unequal amounts of material, would show widely differing costs, because the one having the greater amount of material cost would be penalized with more than its share of overhead.

The second method is less in error, but is fallacious in two respects: First, it assumes that the cost of overhead bears the same relation to direct labor costs throughout the plant; and second, it takes no consideration of the varying rates paid for labor on the same kind of work. For instance, overhead in one department might bear to direct labor a ratio that was much higher than the ratio in another department. Also, two mechanics might be paid different rates of wages on the same kind of work. In the first instance, work done in the department having the high ratio would be favored, and in the second, the product on which the cheaper man worked would bear less than its share of overhead, although the same proportion of available productive time in the department might have been used on each unit produced.

The third method, while more nearly exact than either of the others, nevertheless assumes that the cost of overhead based on hours of direct labor is the same, whether the worker is operating a cheap drill press at a total hourly cost including his labor, of, say, $1.10 per hour, or an expensive boring mill, which, with labor, may cost as high as $3.50 for every hour it is operated. Figured by this method, the cost of a part that requires expensive equipment to manufacture will bear less than its proper share of overhead, while the cost of one requiring cheaper equipment will carry more. This tends to overload the costly equipment, while cheaper equipment may go begging for work, if the work is obtained by bidding for it in a competitive market.

Neither the second nor the third method would be so far wrong if all the parts that were processed were put through the same operations and took proportional amounts of effort in each department; but in making job lots of miscellaneous work, the facts do not disclose such an ideal condition. Hence, the executive with accurate cost records has the advantage; for how can any confidence be placed in an estimate of the cost of a part that may require as many as twenty-five different operations on, perhaps, a dozen different classes of machine equipment, performed by labor of as many different wage rates, unless the estimate is based on actual performance and the overhead is applied in some measure in proportion to the use of the equipment? Therefore, a method of applying overhead more equitably and one more in harmony with the basic principle must be used. What information is necessary and how shall it be used?

If all the factors on which a price or a quotation is based are accurately known, the manager of a business knows exactly what he is doing when he sends out a quotation. On the other hand, if he has no cost system to furnish him with definite information, he must depend either on his own judgment or on that of some member of his organization. Judgment in matters of cost is always uncertain. The executive depending on judgment alone has no exact knowledge of the point at which profits cease and losses begin; and even when he fills an order at an apparently fair price, he never knows whether it represents a profit or a loss.

The Machine-hour Method of Applying Overhead

Here is where the well developed cost system comes to the aid of the perplexed executive whose plant is manufacturing a diversified product. By the use of facts based on the actual performance of his equipment, and presented to him in the language of dollars and cents, it shows him how to apply overhead by a method in complete harmony with the fundamental principle that has been stated, namely, on the basis of the proportion of available productive time of the equipment required to do the work. The process of application by which this is accomplished is known as the "machine-hour" method. To use it, requires merely one further step than the direct labor-hour method just described.

To apply factory overhead on a machine-hour basis, it becomes necessary to break down the items of plant overhead not merely by departments, but by individual machines or groups of machines within each department. It is necessary also to calculate the total number of hours over a given period that each machine or group should be used in order to operate the plant at normally profitable capacity. By dividing this number of hours for each machine (or group) into the total overhead applicable to the machine (or group) for the same period, there is obtained a factor that represents the "normal" amount of overhead that should be applied to factory costs for each hour of work that each machine performs on any product. The amount of factory overhead to be applied to costs for the use of any machine, is obtained by multiplying the hours that the machine is used by its normal machine-hour rate.

This method agrees in every particular with the fundamental principle regarding the application of overhead to the product in proportion to the use of equipment in the processing operation. It is sound for estimating purposes, because it will automatically minimize the chances of any part of the plant becoming loaded with the wrong kind of work. As stated, the rate for each machine is based on "normal" operation of the plant, and when such rates are once established by the use of dependable information, no change should be made until every element involved in the change has been analyzed. In particular, no change should be made either during times of slack business or when work is plentiful, because it is only when a complete cycle of plant operations is compassed that a true picture with respect to the overhead element of cost in any plant is obtained.

Because these rates are based on a normal scale of plant operation and because they apply factory overhead to costs on such a basis, they present to the executive a standard by which he can judge the scale on which his plant is operating. Their use also results in the establishment of costs at which he must expect his sales department to get business, and this is another reason why such rates should not be changed unless further study shows that there has been a decided change in conditions since they were established.

The executive who has no exact cost figures often cuts prices too far in order to get business. This not only causes a loss to his own shop if he gets the order, but also tends to demoralize the whole industry of which his plant is a part. It establishes an unprofitable level of prices for the industry as a whole, and is also the cause of extreme sales resistance as soon as any attempt is made to put the prices in that industry back on a profitable basis. It may be necessary at times to take business at less than a satisfactory profit, or even at no profit, but when such an occasion arises, the decision should be based on a knowledge of actual costs.

"Actual" and "Normal" Machine-hour Rates

To make this last statement clear, consider an example. The "actual" hourly rate for any machine will change from month to month. That is, any month during which a machine operates say a smaller number of hours than the normal, the "actual" machine-hour rate for that month will be higher than the "normal" or established rate which we have been discussing. If this actual higher rate for the current month should be used to compile an estimate, the sales manager would be facing the task of obtaining a price for the product on the basis of a cost higher than that at which the plant would normally be capable of producing. In effect, the quotation would be the same as that of a plant of smaller capacity but with overhead the same as that of the larger plant. Therefore, it is wise, when normal rates are once established on the basis of dependable information, to let them stand until complete and mature deliberation indicates the necessity for change.

How Shall Administrative Expenses be Apportioned?

We have seen that direct material, direct labor, and normal overhead applied on the basis of machine-hours consumed in processing operations constitute the elements of factory costs, but what about the other expenses of the business, as for instance, sales and general administrative overhead? How shall these be applied in estimates to arrive at a total cost before any return on the investment is added?

It is plain that these expenses bear no such relation to the cost of individual items as factory overhead, because they are more general in their nature. It is neither feasible nor necessary to make such direct application of them to the product, because the proportion is usually small, and also, there is no basis on which such application can be made. Therefore, it is customary, and a widely accepted procedure, to add to the factory cost a flat percentage to cover these elements. This percentage is based on the relation of the total of this class of expenses to either the total factory cost over a given period or to a given volume of sales. The resulting figure, after the addition of this percentage, is the "sales cost," and contains all the elements of the total cost of making and selling the article. To this total cost, the return on the investment must still be added to arrive at the "selling price" or figure to be quoted.

This way of applying selling and administrative overhead is open to the same criticism as the three methods of applying factory overhead, because it fails to reflect a cost in any way proportionate to the manufacturing effort necessary to produce the goods. After all, it may be argued, the sales department is selling available manufacturing capacity, and this should be reflected in the costs in an amount proportionate to the use of this capacity in processing the goods. The means by which this may be accomplished is to use a selling and administrative expense rate per machine hour.

This method of application is commendable for its simplicity and the expedition which it gives to the estimating process. Before it can be used, there must first be developed a series of factors. Except for material, these factors combine in one figure for each machine all the elements of selling price, namely: Direct labor rate per hour; machine-hour rate of overhead; selling and administrative rate of overhead per machine hour; and return on investment. For instance, with a labor rate of $0.55 per hour, a machine-hour rate of overhead of $1.05, a selling and administrative overhead rate of $0.30 per machine-hour, and a return on the investment of $0.30 per machine-hour, the factor would be for that particular machine:

Labor	$0.55
Machine-hour rate of overhead	1.05
Selling and administrative rate of overhead	0.30
Return on investment per machine hour	0.30
Total rate per machine hour	$2.20

To estimate by this method, the hours required on each machine are multiplied by the respective factors and to the sum of these products is added the cost of material. The resulting sum is the sale price.

Taking as a simple example a gear requiring the use of a machine for three hours, and material which costs $2.60, the estimate would be as follows:

Material	$2.60
Three hours' use of machine at $2.20 per hour	6.60
Selling price to quote	$9.20

This formula, in effect, means that each hour of machine time is calculated to produce its own amount of selling price; and it produces selling prices in which the overhead elements are proportioned to the manufacturing effort.

A Stabilized Industry is Possible Only When Prices are Based on Known Facts

When all the factors on which a price or quotation is based are accurately known, the executive has a firm foundation on which to stand. He knows exactly what he is doing, and he can base his decisions on facts and not on guesses.

On the other hand, the executive who has no cost system to furnish him figures of actual performance and who must depend upon his own judgment, or upon that of some member of his organization, will always be uncertain. Not only will he have no exact knowledge of the point at which his profit will cease and a loss begin, but even should the business be obtained at a seemingly fair price, he will never know whether it yielded a profit or caused a loss.

Too often, in such a case, the price is cut too far, in order to get the business. This not only causes a loss to the plant that is awarded the work, but it tends to demoralize the whole industry to which that plant belongs, because it establishes a lower level of prices generally, and this, in turn, causes extreme sales resistance to develop as soon as any attempt is made to get prices in that industry back to a profitable level.

It may be necessary at times to take business at less than a satisfactory profit, or even at no profit, but whenever such an occasion does arise, whatever decision is made should be based on the solid facts of actual performance. At such a time, the wise manager knows that the expense of maintaining his cost department has been a good investment.

Skill and the Machine Age

In a paper presented by Arthur J. Tuscany, manager of the Gray Iron Institute, Inc., Cleveland, Ohio, before the annual meeting of the American Refractories Institute, the author made an interesting comment on craftsmanship in modern industry. He pointed out that it is customary for those who take the position that modern high-speed production implies a lowering of quality standards to point out that these methods have eliminated the skilled workman and annihilated craftsmanship, without which a superior product cannot be produced.

This is not true. What quantity production has done is to change the way in which craftsmanship is applied to the job. In part, under the factory system, the responsibility for quality, which is the most that craftsmanship implies, is transferred to the engineer and the trained executive, while the workman instead of losing by this shift, is free to specialize and to become skilled in his own sphere.

So often it is remarked by those who know little about industrial production, that the machine has replaced the skill of the worker and that the fine products of the craftsman of the past are no longer available. As a matter of fact, it has been demonstrated that the superior precision of a machine actually results in a more uniform and better product than could possibly be produced by the most skilled workers with hand labor.

Nor is it true that a comprehensive and intimate knowledge of craftsmanship is eliminated under the quantity production system. It is simply transferred from the many to the few, and on those who have had transferred upon them the skill, judgment, and knowledge of a trade or industry, the burden of responsibility is enormously increased. To quote Henry Ford: "I have heard it said that we have taken the skill out of the work. We have not. We have put a higher skill into planning, management, and tool building, and the results of this skill are enjoyed by the man who is not skilled, to his great benefit."

* * *

GRINDING STAINLESS STEEL

Stainless steel is more difficult to grind than ordinary grades of steel, largely because of the fact that it is more dense and dissipates heat slowly. It is easily scorched by grinding, a brown discoloration of the steel being produced. This action is due to the heat generated on the surface, which, in time, will lead to rusting at the scorched points. For this kind of steel wet grinding is far better than dry.

A copious flow of water should be delivered as near the point of contact between the grinding wheel and the steel as possible, so as to keep the temperature low. The writer has found that the most satisfactory wheels for this work are those with abrasive grains from No. 30 to 36, and with a bond such as will release the grains as soon as they become dull. A wheel speed of between 5000 and 5500 feet per minute should be used. The longitudinal feed should be about 50 feet per minute, while the wheel feed should vary up to 0.004 inch.

W. E. WARNER

Building the Gipsy-Moth Plane in America

How a Two-place Plane of Well-known English Design is Being Built in an American Plant by Skilled New England Craftsmen

By FREEMAN C. DUSTON

IN 1928 a group of aeronautical experts determined to build in this country the finest plane that could be produced commercially for training purposes and for private-pilot ownership. To attain this object, the Moth Aircraft Corporation was formed. This corporation acquired from the de Havilland Aircraft Co., Ltd., the franchise to build and distribute the Gipsy-Moth planes in the United States, and on April 3, 1929, completed its first plane in the newly equipped plant at Lowell, Mass. Since then, production has steadily increased.

The plant faces the Lowell airport and has adequate equipment for turning out twenty-five planes per week. Skill, thoroughness, and accurate workmanship are absolutely essential in building these planes to meet the exacting specifications insisted upon by the makers. Happily, these qualities are traditional with the New England craftsmen who comprise nearly the entire personnel of the plant.

The Moth plane was designed by Captain de Havilland of the de Havilland Aircraft Co., Ltd., England, and has been manufactured by this company for the last five years. The Gipsy-Moth shown in the heading illustration is the regular stock plane now being built, and embodies the improvements and refinements resulting from four years of manufacturing, developing, and testing. Seaplane floats which are interchangeable with the landing gear permit using the plane either as a seaplane or a land plane. The plane can also be equipped with skis for taking off on snow-covered fields.

Records Held by Moth Planes

Moth planes hold three official world's records, and their reliability has been proved by more than five million miles of flying. The 1100-mile race around Britain for the King's Cup was won by Moth planes in 1926, 1927, and 1928, and they also secured the second, third, fourth, fifth, and sixth places in this race in 1929, the winner being a 400-horsepower military scout plane. Their sturdiness is indicated by the fact that two stock planes, operated by two pilots of an English flying school, recently dived at a speed of 160 miles per hour to an outside loop.

The folding wings of the plane permit it to be stored in a one-car garage or to be towed by an automobile through ordinary city traffic. This feature of the plane is of interest to civilian plane owners, as is also the low operating cost, which is estimated to be 7 cents per mile under average conditions. This includes all charges except depreciation and the pilot's salary.

The Gipsy four-cylinder, vertical-in-line, air-cooled engine, rated at from 85 to 100 horsepower, gives the plane a cruising speed of from 85 to 90 miles per hour and an operating radius of from 360 to 400 miles with the regular fuel tank equipment. The weight of the plane empty is 990 pounds; the useful load, 660; and the pay load, 350 pounds. It is licensed for a full load weight of 1650 pounds when used as a land plane and 1750 pounds when employed as a seaplane. The length of the plane

is 23 feet 11 inches; the span, 30 feet; and the height, 8 feet 9 inches. With the wings folded, the plane can be stored in a space 10 by 25 by 9 feet.

Materials Used in Building Plane

The fuselage of the plane is made of chrome-molybdenum steel tubing welded together so that it forms a framework which is virtually one solid piece of metal. Both round and square tubing are employed in the fuselage construction. The thickness of the tubing ranges from 20 to 17 gage. When this material is received at the plant, it is subjected to a thorough examination by the company and also by the Department of Commerce inspectors. Certificates giving the history of the heat-treatment and a record of the characteristics accompany each lot of metal tubing. These certificates form a permanent record of the materials entering into each plane. The tubing is all cut to exactly the required lengths and stored in properly marked bins. The ends of the tubes are cut to the exact angles or fish-tail forms required before the tubes are placed in the storage bins. This practice eliminates all machining or cutting in the welding department where the fuselage is assembled.

All sheet-metal parts of steel and aluminum alloy produced in the punch press department are also stored in orderly arranged bins. The wings, ailerons, stabilizers, elevators, and rudders are constructed principally of carefully selected New England white spruce, and the propellers are made of New England red birch. The seaplane floats are made of duralumin.

Plant Equipment

The plant is laid out in departments which are so arranged that the planes under construction follow a definite production line from start to finish. The machine shop is fully equipped with modern machine tools. A separate tool-room takes care of the die and jig work. The welding department is provided with acetylene gas made in the company's own plant, and is equipped with jigs and fixtures designed to produce very accurate as well as interchangeable units.

In addition to a fully equipped heat-treating department, there are sand-blasting, plating, and polishing departments. All metal parts stamped out in the die department are plated to prevent corrosion. The painting department is equipped with air compressors for operating spray guns, and large tanks are provided for applying protective coatings to the wings and fuselage by dipping.

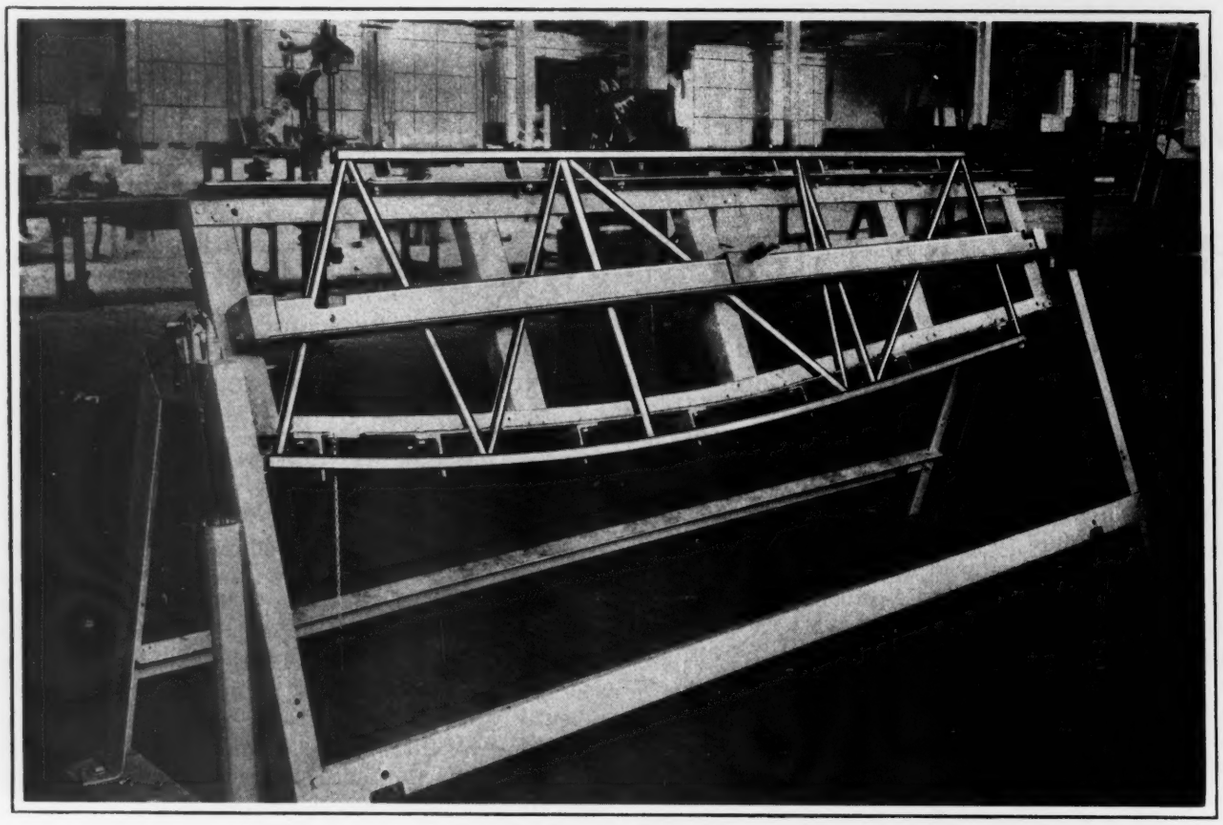


Fig. 1. Welding Jig Used in Producing the Main Forward Section of the Gipsy-Moth Fuselage

Welding Jigs for Fuselage Sections

The first step in building a plane is to construct the fuselage shown in the foreground in Fig. 3. Each side of this structure is made up of three sections. In Fig. 1 is shown one of the welding fixtures used in constructing the main forward section. Three other fixtures of similar design are employed for the engine section, rear section, and tail section. The section on which the engine is mounted may be seen in Fig. 4.

When the construction of a plane is started, the materials required for each section or unit are

placed in large envelopes in the stock-room and delivered to the workmen. The welder who uses the jig shown in Fig. 1, for example, receives only those parts that are required in producing the main forward section of the fuselage. The clamping bar that holds the tubing in place while welding can be released so that each piece of tubing can be placed in its proper locating slots.

After the tubing has been clamped in place, the jig can be revolved on trunnions to bring the work into the most convenient position for welding. The welding rod used in joining the tubes is shown in the holder at the left-hand end of the jig. The oxy-acetylene and oxygen tanks, as well as the welding torch used in this work, are shown at the rear of the jig. After the welding is completed on a section, the joints are wire-brushed to facilitate inspection and to prepare them for the protective coating. The sections are next placed in drill jigs, where holes are drilled for attaching metal parts. These holes also permit the protective coating to reach all the inner surfaces of the tubing.

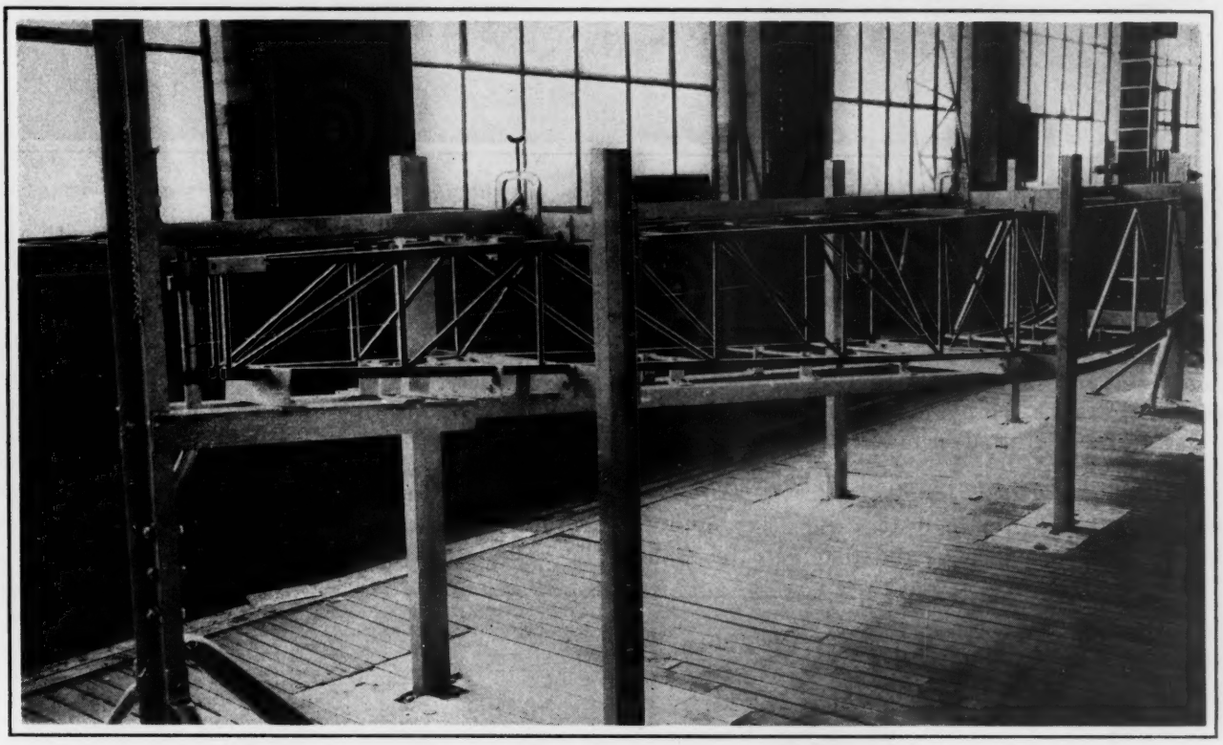


Fig. 2. Jig for Holding the Main Side Sections of Fuselage while They are Joined by Welding

Assembling the Fuselage Sections

The final assembly of the six sections that form the sides of the fuselage is accomplished in the welding jig shown in Fig. 2. As the sections on opposite sides are made in the same jig, they are interchangeable and the two sides of the finished fuselage are therefore exactly alike.

The six sections comprising the fuselage are welded together and joined by crosswise tubes while held in the jig. After being removed from the welding jig, the fuselage goes to the dipping room shown in Fig. 3, where it is immersed in a compound that gives it a thorough protective coating both on the inside and outside of the tubes. At the right of the illustration is shown a fuselage which has just received a protective coating and is being removed from the tank.

Preparing Fuselage for Fabric Covering

After receiving its first protective coating, the fuselage goes back to the assembly floor where it takes its place at the head of a line of fuselages which have already received the same treatment. Each succeeding fuselage in this line is a step nearer completion. When the end of the line is reached, the fuselage has become part of a finished plane which is ready for its test flight.

While in the first position at the head of the assembly line, the fuselage is fitted with the floor cowling, control box, and various small metal parts. The lower longerons are also wrapped with fabric to which the fuselage covering is sewed. From this station, it is removed from the line and taken to the covering department, where the fabric is stretched over the framework and sewed in place.

The covered fuselage then goes to the dope room where it receives four coats of dope. The dope is hand-brushed and all seams and rip stitching are taped. One coat of aluminum followed by two coats of color are then sprayed on. Usually a final coating is given the plane to secure a lustrous finish. Although the present article deals primarily with the fuselage or metal work, it might be of interest to note here that the fabric-covered wings are given the same treatment as the fuselage.

From the dope room, the fuselage goes back to the assembly line where all the outside fittings are

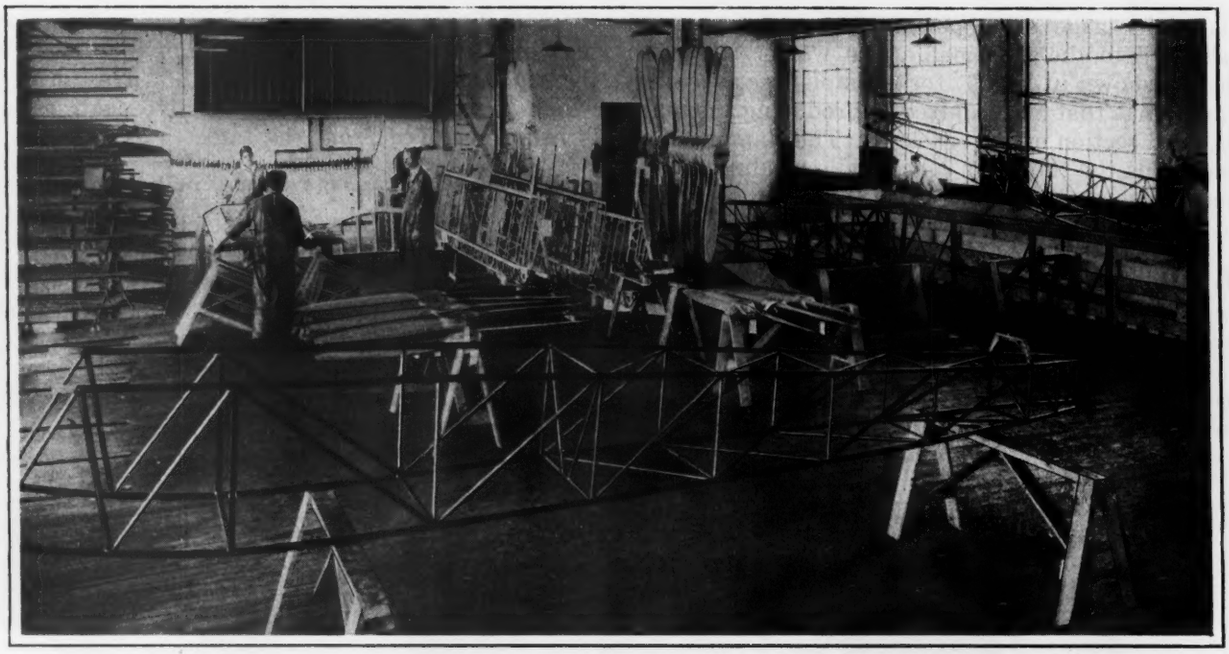


Fig. 3. Corner of Room where the Fuselage, Wing Frames, and Other Units are Given a Protective Coating

attached. It is then moved along through the various stations, at each of which certain parts are added. The wings, fins, stabilizers, and similar parts, which follow along another assembly line paralleling that of the fuselage, are added to the assembly at the various stations. Near the end of the assembly line, the engine, gasoline tank, under carriage, etc., are fitted in place.

Testing the Finished Plane

When the finished plane leaves the assembly line, it is thoroughly inspected and taken to the stand where the compass is properly adjusted with the motor running. Upon being declared ready for its initial trial, it is turned over to the test pilot who takes it up and carefully checks its operation in all flying positions. On completing the test, the pilot makes a detailed report to the chief inspector, and any necessary readjustments are made. The plane is then taken up for its final proof test, which includes at least three loops and six spins, after which it is delivered to the customer or placed in storage.

Future articles will describe the construction of the wings and propellers.

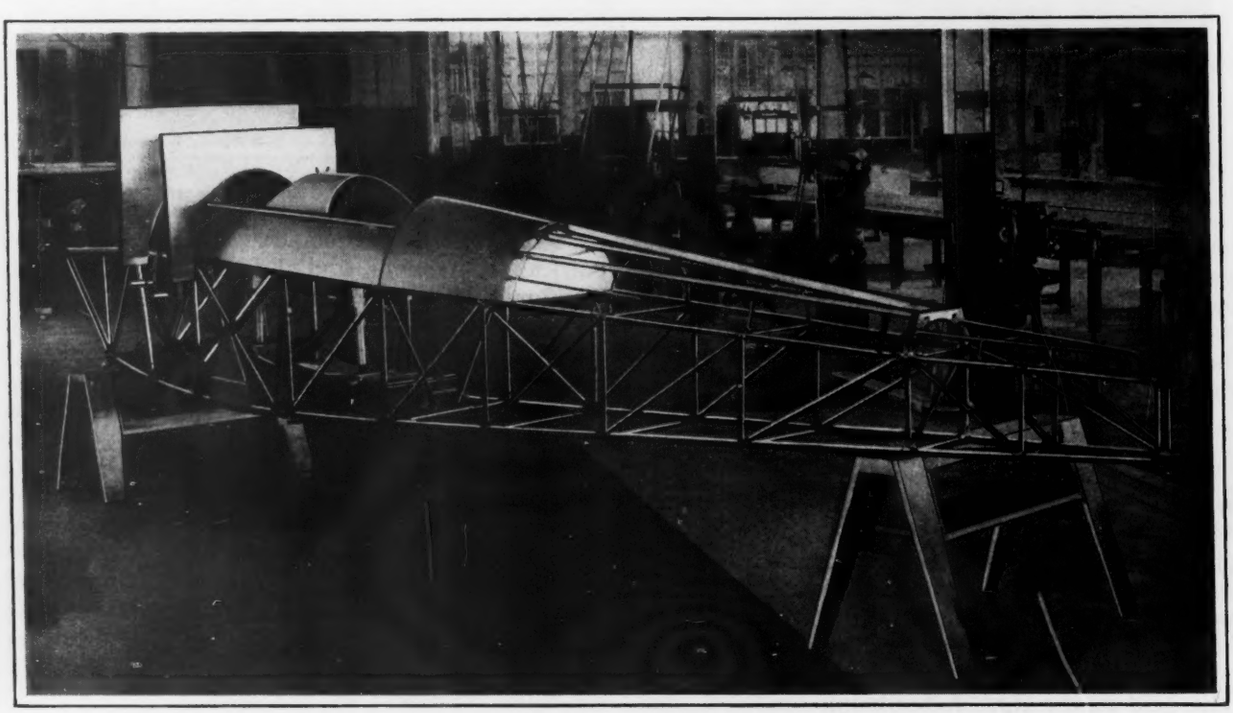


Fig. 4. Fuselage with Ply Wood Floor, Cowling, Control Box, and Other Parts Assembled, Ready to Receive Fabric Covering

Lubricating Tapered Roller Bearings

Kinds of Lubricants and Methods of Application Best Adapted for Different Classes of Roller Bearing Service

By H. L. KAUFFMAN

TAPERED roller bearings are subjected to a wide range of operating conditions in their various applications to automotive and industrial equipment. To obtain effective lubrication under all the conditions encountered, necessitates the use of different kinds and grades of lubricants. It is the object of this article to aid in the selection of the proper lubricant for any specific application. To do this, several factors must be taken into consideration.

It is important that the speed of the bearing be considered in selecting the lubricant. In general, medium consistency and medium-to-soft consistency greases can be used at low and medium speeds, or at speeds under 1000 revolutions per minute. Oil is considered the better lubricant at speeds over 1000 revolutions per minute. Bearings with an outside diameter of more than 6 inches, however, are an exception to this rule, and should be lubricated with grease of a medium or medium-to-soft consistency for speeds up to 500 revolutions per minute, while for speeds above that, oil is a better lubricant.

In selecting lubricants for tapered roller bearings, it may be considered a general rule that medium-consistency and medium-to-soft consistency greases should be used for speeds under 1000 revolutions per minute. Oil is a better lubricant for speeds over 1000 revolutions. Bearings with an outside diameter of more than 6 inches, however, are an exception to this rule, and instead of 1000 revolutions per minute, a speed of 500 revolutions is considered the boundary line between grease and oil. Bearings operating under high-temperature conditions require a lubricant of unusually high viscosity. A soda-base grease is adapted for this service unless the temperature is over 200 degrees F., when a heavy oil should be used. For bearings that are exposed to extremely cold weather, a highly refined mineral oil is recommended.

Lubricants Suitable for Varying Temperature Conditions

The lubricant employed for tapered roller bearings must be of the proper consistency to suit the method of application and the type of bearing closure, as well as the speed and temperature requirements. When the bearing is used under high temperature conditions, a lubricant of unusually high viscosity is required. A lime-base grease will have a tendency to break down at approximately 175 degrees F. A soda-base grease does not tend to separate until it reaches a temperature of about 200 degrees F., and is therefore better adapted for use under higher temperature conditions.

Precautions should be taken to keep greases of the soda-base type free from water, since they emulsify more readily than those having a lime base. For temperatures above 200 degrees F., the best results are obtained with a heavy oil having a viscosity of 100 to 150 seconds Saybolt at 210 degrees F.

Oils used for lubricating bearings exposed to extreme cold should pass a low cold test. A highly refined mineral oil with a viscosity of 100 to 500 seconds Saybolt at 100 degrees F. is recommended for this class of service. The viscosity depends to some extent on the method of applying the oil. In cases where the speed is very high, and physical limitations prevent the use of a closure that will hold a light oil, it is best to employ a special soda-base grease.

A specific recommendation for each type of machine is the most satisfactory method of insuring proper lubrication. The following recommendations are classified according to the type of application rather than by the different operating speeds. Bearings mounted on stationary shafts, such as are used for automobile and tractor wheels, farm implement wheels, road machinery wheels, and other similar applications, can be lubricated with a grease of either medium or medium-soft consistency, when the speed is below 1000 revolutions per minute. The medium-consistency grease may have a Karns-Maag test of from 15 to 30 millimeters, and the medium-to-soft grease, a test from 25 to 40 millimeters. The medium-consistency grease is a little heavy for use with a grease gun, and, therefore, the method of applying the grease may determine whether the medium or the medium-soft grease should be used.

Lineshafts, pulley blocks, loose pulleys, hoisting drums, and other rotating shaft applications, where the speed is 1000 revolutions per minute, can also be lubricated by greases of medium or medium-to-soft consistency, if the closures are suitable and no unusual temperature conditions obtain. Heavy machines such as well-drilling equipment, clay and brick machines, paper-making machines, and steel mills equipped with tapered roller bearings having good closures give the best service if lubricated by heavy oil having a Saybolt viscosity test of from 100 to 150 seconds at 210 degrees F.

The roller bearings used in gear-boxes of machine tools, power take-offs, and marine reverse gears running at speeds up to 2000 revolutions per minute can be satisfactorily lubricated by oil having a viscosity of 500 to 1000 seconds Saybolt at

100 degrees F. when effective bearing closures are provided. Oil of 500 to 1000 seconds Saybolt viscosity is satisfactory for the tapered roller bearings of centrifugal pumps, blowers, and pulverizers having speeds up to 2000 revolutions per minute when large lubricant chambers and passage-ways around the bearings provide good oil circulation.

High-speed grinders, woodworking machinery, and similar equipment operating at speeds over 2000 revolutions per minute can be lubricated by drop-feed oilers adjusted to supply from two to six drops of oil per minute, using an oil having a viscosity of 150 to 250 seconds Saybolt test at 100 degrees F. A very small quantity of oil is required in the bearing chamber. The rollers of the bearings should dip into this oil only 1/8 inch at the lowest position. This provides lubrication for the bearings when the machine is first started and the drop feed supplies the lubricant afterward. A drain must be provided which will keep the oil at the established level, as any surplus of oil that collects in the bearing chamber will cause heating.

Specifications Recommended for Roller Bearing Lubricants

Grease should be compounded from a high-grade soap and a highly refined, well filtered mineral oil, free from acid, alkali, or any filler that can act as a lapping agent. The maximum moisture content of the grease should not be more than 2 per cent, and the grease should not emulsify readily with water. The ash content should not exceed a maximum of 2 per cent and should not discolor a bright copper plate submerged in the grease for a period of twenty-four hours. Oil used in the grease should have a viscosity of not less than 200 seconds Saybolt at 100 degrees F. The minimum flash point should be 340 degrees F. and the minimum fire point, 380 degrees F.

Grease of medium consistency, such as is generally used at speeds below 1000 revolutions per minute, is considered too heavy for grease gun application. The heavy limit as tested or measured by the Karns-Maag system is 15 millimeters, and the lightest limit, 30 millimeters at 75 degrees F. Grease of medium-to-soft consistency, such as is generally used at speeds below 1000 revolutions per minute, tests from 25 to 40 millimeters at 75 degrees F. and can be applied with a grease gun.

Bearings that have an outside diameter larger than 6 inches and run at speeds above 500 revolutions per minute, should be lubricated by a highly refined, well filtered, neutral mineral oil having a viscosity of 500 to 1000 seconds Saybolt at 100 degrees F. The same requirements apply to oil for speeds above 1000 revolutions per minute and up to 2000 revolutions per minute where the outside diameter of the bearing is less than 6 inches. For bearings of this class, passageways should be provided so the oil can circulate around the bearings.

Some Applications of Tapered Roller Bearings

The fact that tapered roller bearings are used in the great majority of passenger automobiles, trucks, trailers, buses, and motorcycles is sufficient reason for carefully considering the problems encountered in lubricating this type of bearing.

Tapered roller bearings are also employed in many other fields in which similar lubricating problems are encountered. In the field of aviation, these bearings are used in airplane motors and in landing wheels of planes. In the railway transportation field, they are applied to passenger and freight car journals and also to the journals, transmissions, and drive pinions of gas-mechanical and gas-electric railway cars. They are also used for the motor armature shafts and the journals of electric cars for city or interurban service. Industrial locomotives, rail motor cars, crossing gates, baggage trucks, and various other types of railway equipment and rolling stock are equipped with tapered roller bearings. Farm machinery also utilizes tapered roller bearings extensively. Their industrial applications are so extensive and so well known as to hardly need mention.

* * *

A CENTENARY IN AMERICAN INDUSTRY

This year it is one hundred years ago since Thaddeus Fairbanks built the first platform scale at St. Johnsbury, Vt., thereby laying the foundation for the business now known as Fairbanks, Morse & Co., with headquarters at Chicago, Ill. Up to that time, methods for weighing were very primitive and no important improvement had been made since ancient times in this field. The platform scale invented by Thaddeus Fairbanks in 1830 involved principles upon which practically all modern scales are based.

The first platform scales built by Fairbanks were for weighing hemp, a product grown in great quantities in Vermont in those days. It is a remarkable tribute to the genius of the St. Johnsbury inventor that a design made by him one hundred years ago should continue practically unchanged in principle during all these years.

The same is also true of the "straight lever" railroad track scale for which a United States patent was granted to Fairbanks in 1857, he being the first to introduce these scales into the United States. Track scales have been manufactured continuously at the St. Johnsbury plant of Fairbanks, Morse & Co. for nearly seventy-five years. Many improvements have, of course, been made, but with few exceptions, the general principles of the early invention have been retained in scales of this type.

What is said to be the world's largest scale was recently built at the St. Johnsbury plant for the Hamilton Furnace Co., Hamilton, Ohio. This scale is used for weighing a movable mixer built on railroad trucks, the scale weighing the entire load—the car and its contents—and having a capacity of 1,000,000 pounds. This large scale is an exact duplicate of regular Fairbanks railroad track scales except for its large proportions. In spite of its great capacity, its accuracy is guaranteed to within 20 pounds, or within 0.002 per cent of the capacity of the scale.

New England Shops Install Modern Equipment

During the Last Five Years the Shops in New England have Discarded Many Obsolete Machines for New High-production Equipment

By ALBERT R. STEDFAST, President, Stedfast & Roulston, Inc., Boston, Mass.

WHAT is New England doing in the way of replacing obsolete equipment with new and up-to-date machinery so as to be in a position to maintain its well earned reputation in the manufacturing field? This question may be answered briefly as follows: The manufacturers in the New England states have been very active during the last five years in installing new equipment to take the place of obsolete and worn out machinery, and 1929 marked the biggest year so far in the buying of new equipment for machine-building and metal-working plants.

Albert R. Stedfast

In order to survey the conditions properly, we must go back to the war years. During that period, the machinery installed in most plants was not only used continuously but also much abused. The machine tool equipment especially was in bad shape, and after the war, was not fit for use in successful competition with that of better equipped plants in other parts of the country.

The general slogan of the men who realized what had to be done in order to enable New England to hold its own in a highly competitive market was "Production." Immediately after the depression that followed the war, the machine tool builders of the country developed a great many new machines. They and their dealers made a great effort to impress upon the manufacturers all over the country, and especially in New England, that these new machines were necessary in order to increase production and maintain quality.

The plants in New England, as a rule, are older than those in other parts of the country, and for this reason many of them had much equipment that had to be classified as obsolete. It was difficult at first to convince manufacturers that the new and highly improved machine tools were a necessity to them, but during the last five years there has been a noticeable appreciation of this fact, until, as mentioned, 1929 proved to be the biggest year in machine tool sales in the New England states. Furthermore, the result of this installation of new equipment has been most gratifying in that it has enabled New England manufacturers to compete with the rest of the country in the output of their machine-building and metal-working plants and get their share of the business. The manufacturers have been greatly assisted by the New England Council in accomplishing this result. A survey of the machine shop and foundry industries made by this organization some years ago proved that much of the equipment then in use was obsolete, and New England manufacturers immediately began to take steps to remedy this condition. The survey of the New England Council was made by men thoroughly experienced in both commercial and industrial problems; hence, their findings were not lightly passed over by industry as a whole. In this connection, it should be mentioned that the New England machine tool manufacturers themselves have been among the biggest buyers of new equipment during the last two years. They have practiced what they preached and have reaped the benefit in the form of some very successful years for themselves.

The larger corporations, particularly, have shown themselves ready to consider improved equipment. Their production is great enough to warrant the replacement of machines that are only partially obsolete. It has, however, been sufficiently demonstrated by the experience of the last few years that any manufacturer who produces in reasonable quantity can use the new and improved machine tool equipment to great advantage. A jobbing shop, on the other hand, where a machine may only be used occasionally for odd jobs, can often get along all right with an old machine. It is here that the experienced machine tool salesman can render valuable service. He is in a position to advise the manufacturer when and where the newly designed equipment can be bought to advantage. He can pass through a shop and point out what is obsolete; and where obsolete machines are used on production work, there is no question but that they should be replaced immediately. Many manufacturers believe that they have an up-to-date shop. They say so to the salesman who calls upon them, but an inspection of their shop will usually disclose the fact that they have much equipment that is wasting time and labor.

The salesman who is a specialist knows that production machines are not suitable for all shops, and

his judgment in the selection of equipment is now being freely sought by many manufacturers. The time has passed when a capable salesman of machinery merely attempts to make a sale. His object now is not only to make a sale but to make a friend of the buyer, and that can be done only by selling equipment suitable for the manufacturer's needs.

The writer has been in the machine tool sales business for nearly forty-six years. More than thirty years ago he was on the road selling machine tools. At that time the machines available were more or less alike, and price and sometimes weight were the main considerations in buying equipment. Now these items are actually the least important—it is the quality and the special features of each type of machine that determine the purchase. The salesman, therefore, must be a specialist on the class of machine that he represents. He must be able to explain the advantages of its operation and deal intelligently with its power, speed, feeds, and other items that determine its productive capacity.

A recent case may prove of interest. A machine tool salesman studied the methods used in what is considered an exceptionally well equipped plant. He found that, on a certain part, the work was done in a machine in ninety hours with three separate set-ups. The machine used was not of an obsolete type. It was rather a modern machine and the methods used in the plant were considered quite up to date. However, still later equipment had been developed, which made it possible to perform the three operations at one time. The set-up was thoroughly studied, so that time was saved wherever possible, not only in the actual machining work, but in the preliminary work as well. In this way, it was found possible to do the work in twenty hours, as compared with the ninety hours previously required. This, of course, may be an extreme example, but, nevertheless, there are many instances where at least one-half or one-third of the time formerly taken may be saved by the installation of new equipment.

A Code of Ethics for Buying and Selling

Believing that lack of appreciation of the common interests of buyers and sellers is responsible for great losses to American industries, members of a committee working in cooperation with the National Association of Purchasing Agents have launched a campaign of education to reduce this waste. The elimination of such waste will insure a satisfactory profit to the producer, economy to the consumer, and greater efficiency in commercial relations.

The National Association of Purchasing Agents recognizes that a concern that buys must also sell, that buying and selling are companionate functions, that sound commercial transactions must be mutually profitable, and that cooperation between buyer and seller will reduce the cost of purchasing, sales, and distribution, with consequent benefits to industry as a whole. In furtherance of these principles, the National Association of Purchasing Agents has sponsored the following rules in buying and selling:

1. To buy and sell on the basis of value, recognizing that value represents that combination of quality, service, and price which assures greatest ultimate economy to the user.

2. To respect our obligations and neither expressly nor impliedly to promise a performance that we cannot reasonably expect to fulfill.

3. To avoid misrepresentation and sharp practice in our purchases and sales, recognizing that permanent business relations can be maintained only on a structure of honesty and fair dealing.

4. To be courteous and considerate to those with whom we deal, to be prompt and businesslike in our appointments, and to carry on negotiations with all reasonable expedition so as to avoid trespassing on the rights of others to the time of buyers and salesmen.

5. To avoid statements tending to injure or discredit a legitimate competitor, and to divulge no information acquired in confidence with the intent of giving or receiving an unfair advantage in a competitive business transaction.

6. To strive for simplification and standardization within the bounds of utility and industrial economy, and to further the development of products and methods that will improve industrial efficiency.

7. To recognize that character is the greatest asset in commerce, and to give it major consideration in the selection of customers and source of supply.

8. To adjust claims and settle disputes on the basis of facts and fairness, to submit the facts to arbitration if a mutual agreement cannot be reached, to abide by the decision of the arbiters, and to resort to legal measures in commercial disputes only when the preceding courses prove ineffective.

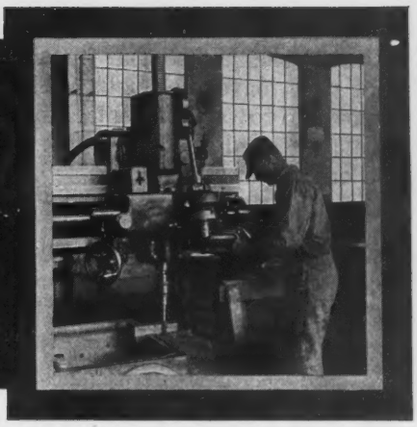
9. To provide or accept no gifts or entertainment in the guise of sales expense, where the intent is to unduly prejudice the recipient in favor of the donor as against legitimate competitors.

10. To give or receive no bribes, in the form of money or otherwise, in any commercial transaction, and to expose commercial bribery wherever encountered for the purpose of maintaining the highest standard of ethics in industry.

* * *

After more than 120 years of existence, the first gas tank ever built is still standing at Smethwick, England. The wrought-iron cylinder was erected in 1808 by William Murdock, founder of the manufactured gas industry.

Letters on Practical Subjects



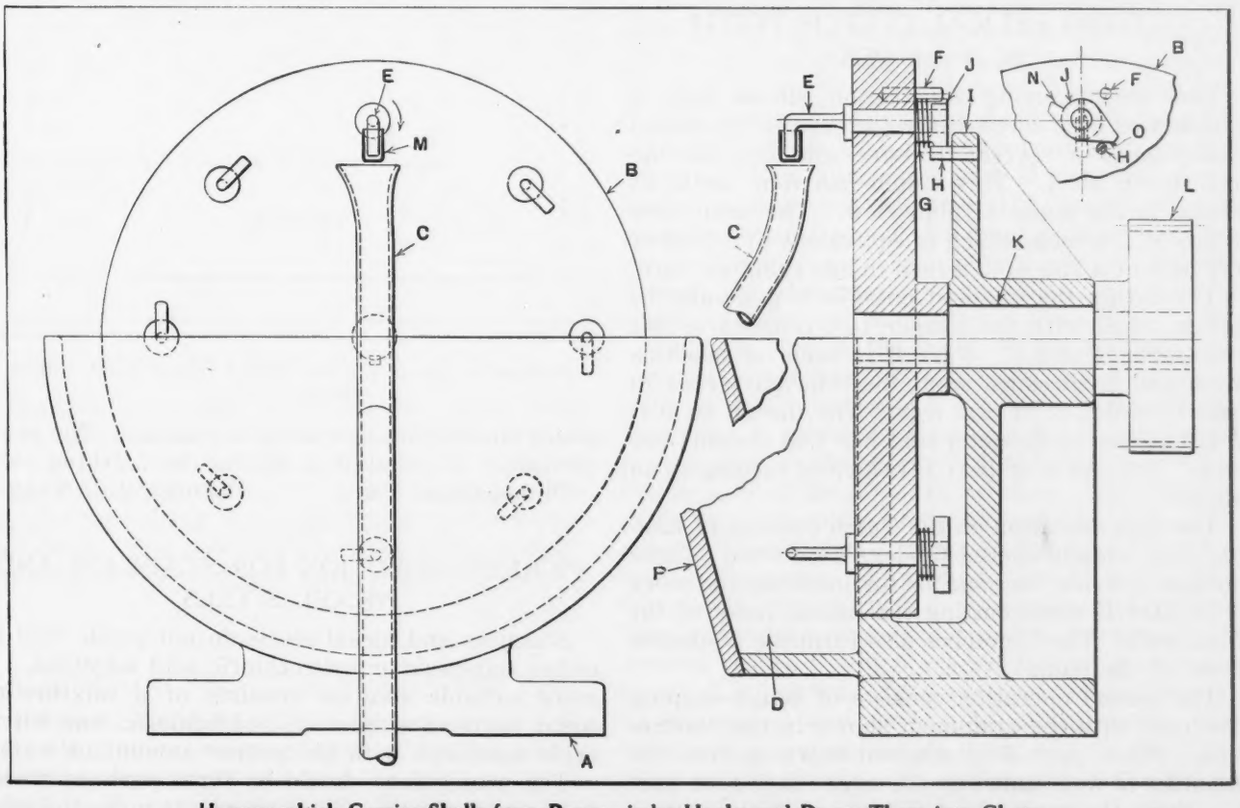
HOPPER FOR BRASS SHELLS

The feeding of brass shells to power presses is done in many different ways, one of which is shown in the illustration. In this case, a series of hooks, pivoted in the face of a revolving disk, pass down through the shell reservoir of the hopper. These hooks, entering the open end of the shells, carry them to the top of the disk, where they are dropped into the open end of a chute by the automatic pivoting action of the hooks.

The base *A* of the hopper is fastened by bolts to a suitable bracket on the power press. Cast integral with the base is the rounded portion of the hopper reservoir *D* and the bearing for shaft *K*. This shaft is keyed to the disk *B* and the gear *L*, the latter meshing with another gear on the end of the press crankshaft, from which the required motion is imparted to the hopper. There are eight hooks *E* having journals which are a running fit in the disk and on the end of which are doweled the dogs *J*.

The chute *C* passes through the wall *P* of the hopper and is held in position by clamp brackets (not shown). The dog pin *H* is a drive fit in the extension arm *I* on the shaft boss. The coil spring *G*, one end of which is inserted in a small hole in the disk *B*, and the other end in a similar hole in the dog *J*, serves to hold the lug *N* against the pin *F* when the dogs are in their normal position.

In operation, disk *B* revolves continuously in a clockwise direction. The hooks, passing down through the reservoir *D*, enter the open ends of the shells and carry them up to a position near the top of the disk. Further motion results in the lug *O* of dog *J* engaging the stationary pin *H*, which imparts a partial revolution to dog *J* and hook *E*, the latter revolving in the direction of the arrow. The shell, dropping off the hook, enters the chute *C* and



Hopper which Carries Shells from Reservoir by Hooks and Drops Them into Chute

passes by gravity to the press. The mouth of chute *C* is shaped so that the shells can easily enter it as they leave the hooks. The wall *P* was made removable to facilitate machining the semicircular bore for the disk *B*.

Glen Ridge, N. J. J. E. FENNO

BUILDING UP BROKEN GEAR TEETH

It may interest some of the readers of MACHINERY to learn what we are doing here in Australia in reclaiming broken gear teeth by the oxy-acetylene process. The method known as the "S.I.F." (Suffolk Iron Foundry) bronze welding process has been used in our shop for some time and has proved satisfactory.

First, the broken part must be metallically clean —by this I mean, it must have a bright lustrous surface, free from all dirt. The surfaces are brought to a red heat by the oxy-acetylene flame and a flux applied to the heated parts, which are then tinned, after which the tooth is built up in the ordinary way by using a special bronze rod. This bronze rod and the flux are made by the Suffolk Iron Foundry Co. in England. The main advantage of the use of this material we have found to be that the tooth, after cooling, is much easier to machine and is better able to resist breaking strain. Another important advantage of this process is the fact that no preheating of the job is required and that nothing need be done to assure slow cooling, as in ordinary cast-iron welding.

Preston, Victoria, Australia C. J. DROLZ

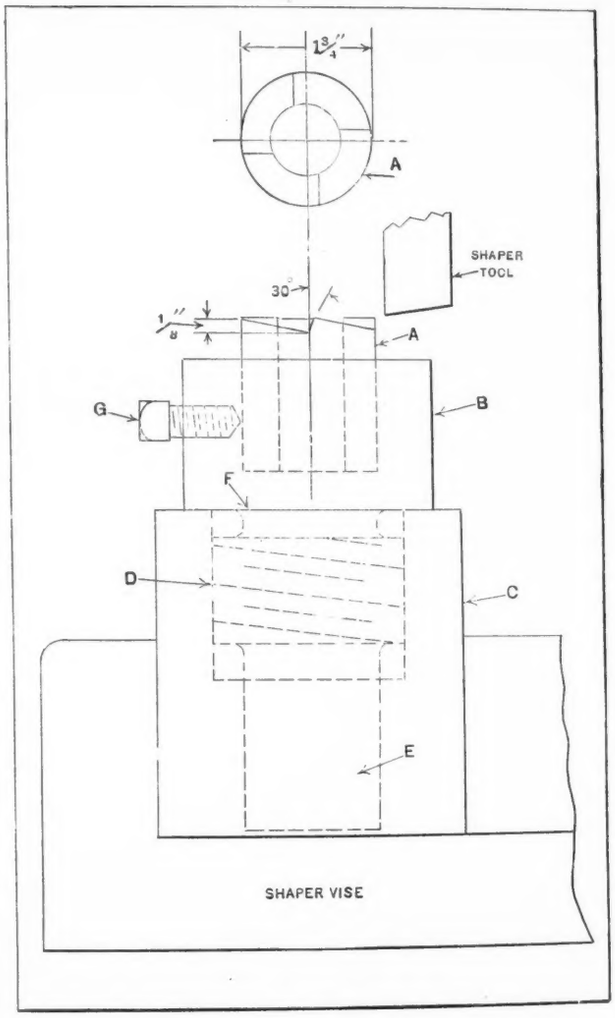
CUTTING HELICAL CLUTCH TEETH ON A SHAPER

The accompanying illustration shows how a shaper was used successfully for cutting the helical clutch teeth of several tool-steel clutches like the one shown at *A*. This clutch has four teeth, as shown in the upper or plan view. The teeth have a rise of 1/8 inch, which is equivalent to a lead of 1/2 inch or a rise of 1/2 inch in one complete turn.

The fixture that made it possible to generate the helical teeth with the shaper tool consists of the two parts *B* and *C*. Part *B* is made of machine steel, and is threaded to fit the internal thread in part *C*, which is of cast iron. The thread at *D* is 2 1/2 inches in diameter and has two threads per inch. The end *E* of part *B* is a close turning fit in part *C*.

The first operation on the clutch consists of milling four equally spaced 60-degree notches. These notches provide the spacing for indexing the work *A* in part *B* when cutting the helical faces of the four teeth. The V-notches also form the 30-degree faces of the teeth.

The second operation consists of rough-shaping the teeth with the equipment shown in the illustration. First, part *B* is screwed down so that the shoulder is well seated on the upper face *F* of part *C*. Next, the work is put in place with the bottom of one of the V-notches directly over a center line scribed on the upper face of part *B*. The set-screw *G* is then tightened to hold the work in this position. The helical face of the tooth is rough-shaped by revolving the holder *B* slowly by hand. As the holder revolves, it raises the work to the level of the shaper tool which shapes or generates the helical surface. After the tooth is cut, the holder is screwed down until it is again properly seated on part *C*. The set-screw *G* is then loosened and the work turned around to bring the next V-notch into alignment with the scribed line on the holder, after



Fixture for Use in Cutting Helical Clutch Teeth with a Shaper Tool

which the cutting operation is repeated. The same procedure is followed in taking the finishing cuts.

Philadelphia, Pa. FREDERICK J. NAAB

PICKLING SOLUTION FOR STAINLESS AND NICKEL STEELS

Stainless and nickel steels do not pickle well in either sulphuric or hydrochloric acid solutions. A more suitable solution consists of a mixture of equal parts of sulphuric, hydrochloric, and nitric acids combined with the proper amount of water.

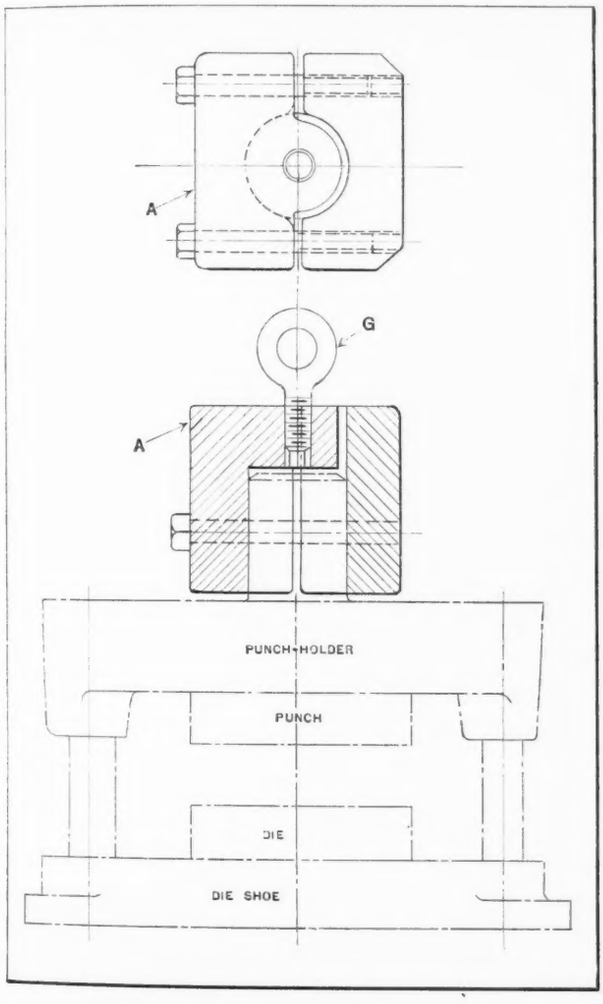
The proportions should be three parts of water to one part of acid. The best way to make the solu-

tion is to place nine parts of water in the pickling tank and then add one part of each of the acids. This will give the proper proportions of acid and water and the articles treated in this mixture will have a smooth white surface.

Brighton, England — W. E. WARNER

CLAMP FOR ASSEMBLING SUB-PRESS DIES

The clamp *A* shown in the accompanying illustration is used to facilitate the assembling of the upper and lower members of heavy sub-press dies.



Hoisting Clamp Applied to Punch-holder

In the shop where this device is used, a great many heavy sub-press dies of the four-post type are used. The clamp can be secured quickly to the shank of the punch-holder. The eye *G* of the clamp provides a means for raising the punch-holder with an overhead hoist. The construction of the clamp is clearly shown in the plan and cross-section views.

B. J. S.

ALIGNING A MULTIPLE PUNCH AND DIE

In making blanking or piercing dies having more than one punch, the importance of having all the punches in true alignment with the holes in the die cannot be too greatly stressed. Blanks cut with a punch and die aligned properly will be clean and free from burrs. Furthermore, the tools will have a longer life and produce more blanks between grinds.

If just one punch is out of alignment in a multiple die, a burr will be produced on all the edges of the blank. The heaviest burr will occur at the crowded side of the unaligned punch, but there will also be a tendency to crowd the other punches sidewise, resulting in lighter burrs on one side of the other edges of the blank. Moreover this crowding will cause the sharp edges of the punches to come in contact with the sharp edges of the die and these edges will soon become dull.

By trying a multiple punch in the die before setting it up in the press, much trouble can be avoided. The writer finds that if the punches will slide easily to a depth of 1/4 inch into the die, little trouble will be experienced from burrs on the blanks or from dull cutting edges on the tools.

Waterbury, Conn. — CHARLES DOESCHER

ROUNDING AND BURNISHING FIXTURE

The illustration shows a fixture for burnishing and rounding the inside of roller-bearing outer races. These races are of the split spring type, made from flat strips of planished steel stock, blanked out as shown at *X* and then rolled in a special machine of the three-roller type to the circular form shown at *Y*. It was found, however, that this rolling machine did not produce an accurate circle, so the fixture and burnishing tool shown were designed to correct this condition.

For the operation, the fixture is fastened securely to the table of the drill press, and the operator inserts one of the split races between the stationary jaw *B* and the sliding jaw *C*, so that the stop-pin *D* enters the opening in the race. The sliding jaw *C* is then moved in by means of the cam *E* mounted on handle *F*, so that the race is sprung in and clamped. The burnishing tool is next fed down against a stop, and performs the burnishing and rounding operation on the inner diameter of the work. The operator holds the tool down for several seconds and then raises it, opens the vise jaws by means of handle *F*, and removes the work.

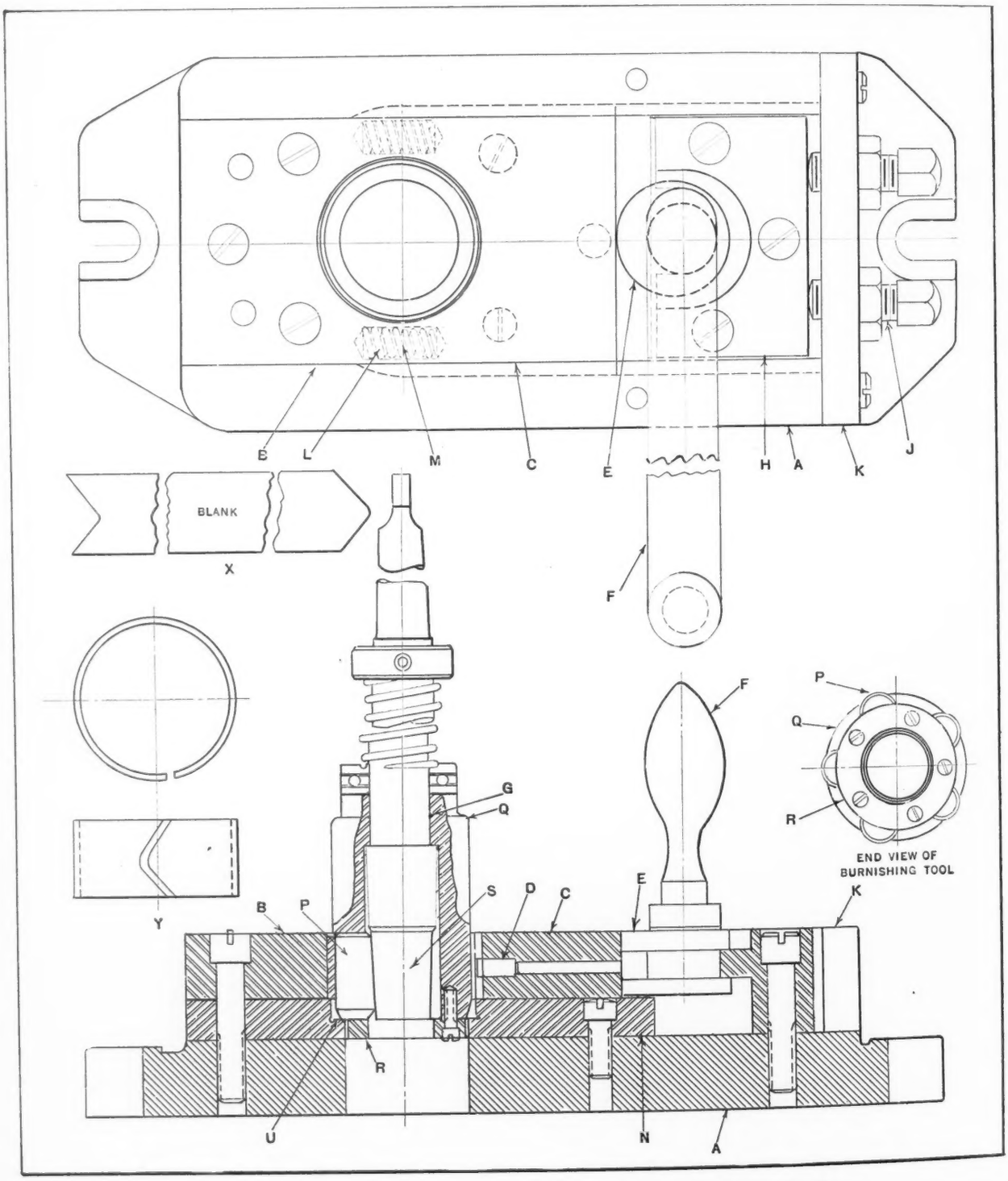
The jaw *B* and the plate *N* are screwed and doweled to the base *A*, while the jaw *C* slides in slots cut in the base and is actuated by the cam *E*. The plate *H* serves as a bearing for this cam and is supported by the screws *J* in the strap *K*. When the faces *M* of the jaws are together, the formation of an accurate circle of the proper diameter is insured. The springs *L* separate the jaws when the cam is released. The ground plate *N* serves as a stop for the race, as well as for the burnishing tool. The burnishing tool contains five hardened and ground rollers *P* which are ground to an included taper of 2 degrees. They are confined in the cage *Q*, the cap *R* also serving to retain them. The spindle *G* is ground at its lower end to twice the taper of the rollers. The other end is tapered to fit the spindle of the machine.

When the tool is fed downward, the ends of the rollers rest on a seat *U* in the hardened plate *N*, stopping the downward movement of the cage *Q*. While the spindle *G* still advances, the rollers *P* move outward through the action of the taper at *S*. This outward movement forces the rollers against the inner walls of the race, and they roll against the walls several seconds under pressure, thus producing the required rounding and burnishing effect. A light machine oil is used for lubricating the surface being burnished.

New York City — B. J. STERN

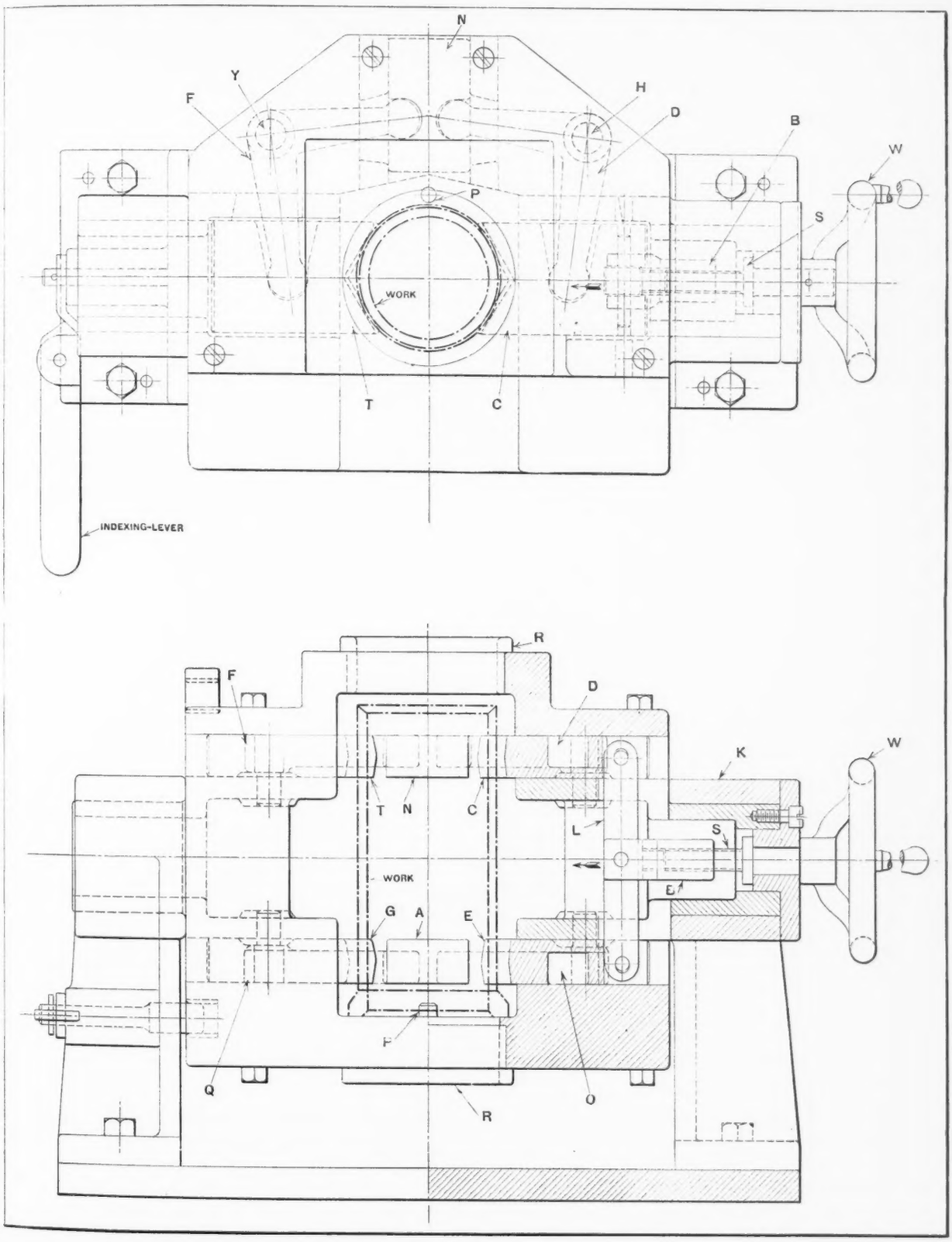
INDEXING JIG WITH WORK CENTRALIZING LEVERS

The indexing jig shown in the accompanying illustration was designed for countersinking both ends of tractor-motor cylinder barrels on a single-spindle drill press. These countersunk ends are used as a means of locating the barrels during all the subsequent machining operations, and as only 1/32 inch of stock is to be removed from the outside diameter of the barrel, a fairly accurate locating arrangement for the work was required.



Fixture for Burnishing and Producing a True Circular Shape in Roller Bearing Races

To suit this condition, two pairs of V-blocks for holding the barrels were provided with centralizing levers. These V-blocks *C*, *E*, *G*, and *T* slide in the jig casting, and are moved from or against the barrel by turning the handwheel *W* on the screw *S*. The latter screws into the nut *B* which is connected to V-blocks *C* and *E* by the equalizing lever *L*. Any sliding movement of V-blocks *C* and *E* is transmitted to V-blocks *T* and *G*, on the opposite side of the barrel by bellcrank levers *F*, *D*, *Q*, and *O* and slides *N* and *A*. One end of each of these levers, which are pivoted at *H* and *Y*, engages a corresponding groove cut in one of the slides, while the other end engages a groove in one of the V-blocks.



Jig with Arrangement for Centralizing the Work as well as Equalizing the Clamping Pressure

In loading the jig, the handwheel *W* is turned in a counter-clockwise direction until the V-blocks have opened sufficiently to admit a cylinder barrel against the temporary stop-pin *P*. The rotation of the handwheel is then reversed until the V-blocks clamp the work securely in position.

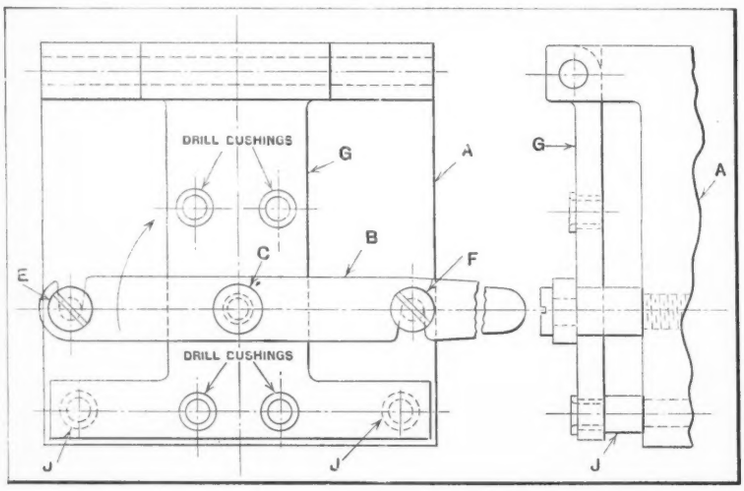
As all four of the bellcrank levers are identical, it is obvious that the two upper V-blocks must always be an equal distance from the center of the drill bushing *R*, as is also the case with the two lower V-blocks. The lever *L* permits V-blocks *C* and *T* to move independently of V-blocks *G* and *E*, so that all four V-blocks will grip with an equal pressure in case the diameter or contour of the barrel varies along its length.

Chicago, Ill. E. NIEDERER

QUICK-OPERATING JIG LEAF

An unusual type of jig leaf, the chief advantage of which is its speed of operation, is shown in the accompanying illustration. The leaf, which is hinged in the usual manner, is provided with special means for unlocking and locking it. This is done by the use of a lever which permits the leaf to be raised or lowered in conjunction with the locking or unlocking motion.

Referring to the illustration, *A* indicates the base of the work-holding fixture. Lever *B* swings about the stud *C*, which is screwed into the cover. Two U-shaped slots in lever *B* hook under grooved screws at *E* and *F*, these slots being cut out so that when the lever is swung in the direction opposite to that indicated by the arrow, it will swing clear of the grooved screws, permitting the jig leaf to be swung back out of the way, so that the work can be manipulated in the jig.

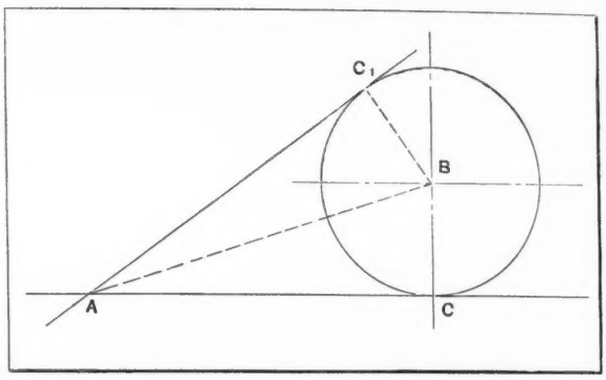


Jig Leaf that can be Swung and Locked in One Continuous Motion

In swinging the leaf back into the drilling position on the stop-pins *J*, the lever *B* is swung in the direction of the arrow, so that the slots in the lever engage the screws *F* and *E*, thus locking the leaf in place. Although not shown, stop-pins may be added to the leaf *G* for limiting the movement of lever *B*. H. M.

GRAPHIC METHOD OF FINDING CIRCUMFERENCE OF CIRCLE

A short time ago the writer discovered the following method of determining the approximate circumference of a circle without making computations. The method consists of making a simple lay-out on the drawing-board. The use of a drafting machine equipped with a protractor greatly facilitates the lay-out. To find the approximate



Lay-out for Finding Circumference of Circle

circumference of a given circle, it is only necessary to draw the circle and then draw two lines *AC* and AC_1, as shown in the accompanying illustration.

The line *AC* is drawn parallel to the horizontal center line of the circle, and the other line AC_1 is drawn tangent to the circle at an angle of approximately 35 degrees 15 minutes. The distance *AC* from the vertical center line to the intersection of the two lines just drawn will equal one-half the required circumference.

To prove that line *AC* equals one-half the circumference of the circle, we will assume that *BC* equals 1 inch and that angle C_1AC equals 35 degrees 19 minutes 10 seconds. Thus we have

Angle BAC = 17 degrees 39 minutes 35 seconds, approximately

$$AC = BC \times \cot BAC = 1 \times 3.1416 = 3.1416$$

Therefore,

$$AC = 1/2\ (3.1416 \times 2) = 3.1416$$

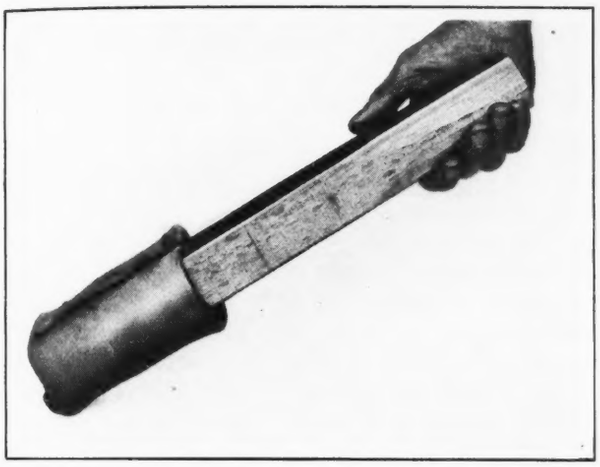
[Obviously, this method could also be used advantageously in some cases to determine the diameter or radius of an arc of a circle of less than 180 degrees. The same principle would apply in measuring a cylindrical piece where more than one-half the metal has been cut away.—EDITOR]

Fort Wayne, Ind. H. L. RITTENHOUSE

* * *

The freight traffic of American railroads handled in 1929, measured in net ton-miles, was the greatest for any previous year, exceeding the traffic in 1926, the highest previous record. This freight traffic was moved by the railroads in 1929 without difficulty and with an efficiency that has never before been attained.

Shop and Drafting-room Kinks



Rubber Mallet for Assembling Painted Parts

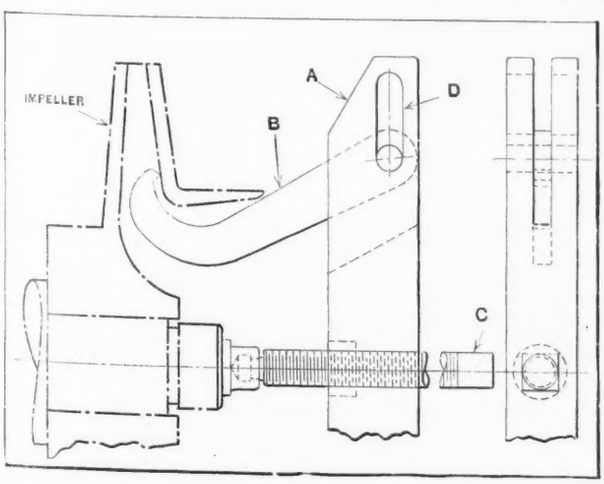
SOFT RUBBER ASSEMBLING MALLET

An excellent soft rubber mallet can be made, as shown in the illustration, by wrapping one end of a stout heavy stick with several turns of an old inner tube, and fastening it down with three or four heavy tacks. This mallet was made for use in assembling some painted machine parts. A smart vigorous tap could be struck on the painted surfaces without marring them, as would be the case if a wooden block and hammer were used.

Missouri Valley, Ia. FRANK BENTLEY

SERVICE KIT EXTRACTOR FOR IMPELLERS

It is very desirable that the tools carried by service men on their trips be as compact and light as possible without sacrificing their utility. The impeller extractor shown in the accompanying illustration has these features, and replaces three extractors previously used for removing centrifugal pump impellers from their shafts. As these impellers vary in size as well as shape, one set of pulling fingers *B* was designed to suit the entire variety. The slot *D* in the bar *A* permits the fingers to be tipped inward a sufficient amount to allow their points to be inserted in the smaller sized impellers. The screw *C* is made long enough to suit the different shaft lengths.

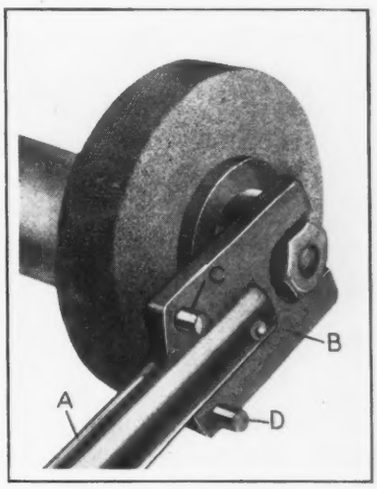


Impeller Extractor of Compact and Light Design for Service Kit

Glen Ridge, N. J. J. E. FENNO

SHOCK TYPE WRENCH FOR REMOVING GRINDING WHEELS

It is often difficult to loosen the nut on a grinding wheel spindle because there is nothing by which the spindle can be readily gripped or held stationary. Usually, the workman either grips the two strands of the belt with one hand while using the wrench or else he runs the wheel backward by hand and jabs at the revolving nut with the wrench. Recently, the writer devised the simple wrench shown in the illustration, which greatly facilitates the removal of grinding wheels. The wrench is designed to jar the nut loose by a blow or shock.



Wrench for Removing Nut from Grinding Wheel Spindle

The handle *A* of the wrench is made of 1-inch cold-rolled steel, and is slotted at one end to receive the jaw *B*, which is made of 3/8-inch flat steel. The jaw is cut out at the end to fit the nut, and is mounted on a swivel pin which passes through the handle. Two short studs *C* and *D*, screwed tightly into tapped holes in jaw *B*, complete the wrench.

The wrench is placed on the nut with the handle in contact with the stud *C*. The belt is then grasped and pulled backward with a quick motion. This causes the spindle to move until the handle comes in contact with pin *D*. Stopping the spindle suddenly in this manner produces sufficient shock to loosen the nut.

Hamilton, Ont., Can. A. KENDALL

* * *

Wages are not so much a matter of supply and demand of labor, as the fitting of a man to the right job and training him to earn more.—*Slices*

Questions and Answers

MATERIAL FOR PERMANENT MOLDS

T. W. T.—What material is used for permanent molds for casting aluminum? Are there any special precautions to be observed in making and using these molds.

This question is submitted to MACHINERY'S readers.

MODULUS OF ELASTICITY FOR SPRINGS

D. W.—What torsional modulus of elasticity is commonly used for designing helical steel springs? Is the same modulus generally used for all sizes of steel wire from music wire up to the comparatively large sizes of wire or rod used for heavy springs?

A.—The torsional modulus of elasticity varies somewhat in accordance with the composition of the steel used and also depends upon whether the spring material was produced by wire drawing, cold rolling, or hot rolling. For example, hard-drawn wire has a higher modulus of elasticity than hot-rolled bars or rods, such as are used for comparatively large springs. In order to obtain figures representing actual practice, this question was submitted to several large spring manufacturers and the following are abstracts of the six replies received:

1. All hard-drawn spring wire, oil-tempered spring wire, and springs made of soft cold-drawn alloy steel, which is hardened and tempered after winding, are given a modulus of elasticity of 11,500,000. The special grade of high-carbon, hard-drawn spring wire known as "music wire" is given a modulus of about 12,000,000. For hot-rolled bars or material 1/2 inch and larger in diameter an average modulus of 10,500,000 is used. The accuracy of the designing practice is checked almost daily with actual springs, and the figures given have proved satisfactory. Some very accurate tests have been conducted to determine the modulus of hot-rolled spring steel bars, and quite a variation has been found, depending upon the size of the material, the refinement of the grain structure, and the amount of cold working to which the spring has been subjected after heat-treatment.

2. Our spring calculations are based on a torsional modulus of 10,000,000 for 0.70 per cent carbon steel; 10,500,000 for 0.90 per cent carbon hot-rolled steel; 11,000,000 for 0.90 per cent cold-rolled steel; and 12,000,000 for music wire.

3. A modulus of elasticity of 11,500,000 to 12,000,000 has been found perfectly satisfactory in the design of our helical springs, most of which are made of small wire. It is believed that for heavy sizes of bar stock the modulus should be about 10,500,000.

4. A torsional modulus of 11,500,000 has proved very satisfactory for steel springs made of carbon steel wire, and this figure agrees with that given in several recent publications by large spring manufacturers. For springs made of alloy steel wire, such as chrome-vanadium, the modulus may be as low as 10,000,000.

5. A great many tests have shown that a modulus of 11,400,000 is a good average without much variation in either direction for wire sizes up to 3/8 inch round.

6. We use a torsional modulus of elasticity ranging from 10,500,000 to 12,000,000. Our troubles have always been with the wire, or the practical side of the problem, rather than with the theoretical side; these have been so great that we installed our own wire-drawing department. Too much contention has arisen regarding the theoretical tables and not enough concerning the mechanical end of the problem. We can produce wire that will prove any table false, although it does not follow that tables are to be condemned. We have just tested two springs, each made from No. 6 wire (0.192 inch) and each having an outside diameter of 1 27/32 inches, a length of 4 inches, and 12 coils. Although these springs apparently are identical, one supports 48 pounds when compressed to 3 1/8 inches and 66 pounds at 2 11/16 inches, whereas the other spring supports 52 pounds at 3 1/8 inches and 82 pounds at 2 11/16 inches.

EMPLOYER'S DECISION AS TO "SATISFACTION" OF EMPLOYE'S SERVICES

R. Q. S.—A master mechanic was employed for a period of one year to superintend the operation of a department in an industrial plant. The contract of employment was in writing and provided for a salary of $4000 per year, and that the employe should work "to the satisfaction" of the employer. The employe worked six months, when he was discharged without notice, and paid only for the time he had worked. The employer gave as the reason that the employe's work was not satisfactory. The employe contends that his work was properly done, that his discharge was not justified, and that he is entitled to his salary for the balance of the year. Is the employer liable for this?

Answered by Leslie Childs, Attorney at Law, Indianapolis, Ind.

Probably not. The Courts have for the most part held that where an employe agrees to work to the satisfaction of his employer, the latter is the sole judge of when he is satisfied. In such cases, the fact that an employe thinks he has been wrongfully discharged, or that his work has been of the required standard, is not material. When the employer states that he is not satisfied, he has the right to discharge. In other words, in contracts

of this kind, the employer alone is the judge of whether the services are to his satisfaction, and if he decides they are not, he is within the terms of the contract in discharging. (182 Pac. 428).

ARRANGEMENT OF MACHINES IN A MANUFACTURING PLANT

H. N.—I am engaged in laying out the location of machines for a new plant. Is it general practice at present to place machines of one type in groups or departments, or are machines usually placed according to the sequence of operations to be performed on the work?

A.—No general answer could be made to this question. Much depends on the kind of product manufactured. Generally speaking, however, it is not modern practice to place machines of one type in a group or department. For example, in most automobile plants, the different units, like the cylinder block, crankshaft, and other main parts, are manufactured complete in one department, and machines of different types are so placed that the work will pass from machine to machine in one continuous line, each operation being performed in sequence. This saves much labor in the handling of materials. Under this system, lathes, milling machines, drilling machines, grinding machines, etc., are all placed in one department, as required.

On the other hand, in the manufacture of tools in quantity, as for example, threading taps, reamers, or milling cutters, it is the usual practice to have a turning department, a milling department, a grinding department, etc., and to have all operations of one kind performed on the tools in departments devoted to one type of operation.

Generally speaking, if the units manufactured are all of the same type, and require many operations to be performed on them, it is best to have the machines so arranged that operation after operation can be performed in order; but if the parts are diversified in character and vary in size, it is generally best to have the machines arranged by departments that each perform a separate kind of operation.

GRAY FINISH FOR TOOLS

L. R.—Is there a simple method or process for producing a gray finish on hardened and tempered tools, such as milling cutters, reamers, etc.?

This question is submitted to the readers of MACHINERY.

* * *

A broader attitude toward the relation between publicity in the editorial columns of engineering and trade journals and the advertising pages is apparent throughout industry. In this connection, the following statement on the letterheads of a well-known advertising agency may well be quoted: "Note to Editor: We submit the material on this sheet for you to judge solely on the basis of its general interest, without relation to any advertising we may have placed in your publication."

THE L. S. STARRETT CO. CELEBRATES ITS FIFTIETH ANNIVERSARY

Among the several leading firms in the machinery and tool industries that this year celebrate their fiftieth anniversary is the L. S. Starrett Co. of Athol, Mass., a firm well known throughout the world as a manufacturer of mechanics' tools, measuring tapes, and hacksaws. This firm was started in a small way by Laroy S. Starrett in 1880; but owing to the fact that Mr. Starrett had that rare combination of qualities—mechanical and inventive genius, together with unusual business ability—the business has grown until today the company employs over 700 toolmakers and mechanics and manufactures over 2500 separate items.

The beginning of this enterprise is an interesting page in the history of American industry. Mr. Starrett worked as a patternmaker and found the fixed-blade try-square of that day a rather clumsy instrument to use. Realizing the need for a handier tool, he made a design and completed the patterns at home, working at the kitchen table night after night, and also using a foot power lathe, which he installed in his room. This was the beginning of Mr. Starrett's manufacturing enterprise.

At the start, he found considerable difficulty in obtaining square-blades that were ground and graduated with sufficient accuracy to suit the requirements of a first-class try-square. This forced him to design machines for the manufacture of his tools; and the ability to grind and graduate accurate scales, in turn, led to the development of a line of machinist's scales, including the first flexible spring-tempered scale, which proved very popular in comparison with the thick heavy soft steel scales available up to that time. The success of the flexible scales, in turn, led to the manufacture of steel tapes.

In 1887, the line of Fay calipers and dividers was added, the patents, stock, and machinery of Charles P. Fay having been acquired by Mr. Starrett. This line of tools successfully competed with the imported tools previously available, which had practically had a monopoly of the market in this field. Mr. Starrett also added micrometers to his line of tools, making many improvements in this branch of manufacture. The process of etching the graduations on hardened steel tools was developed and patented by him.

The business constantly grew, buildings and machinery being added from time to time until in 1894 a very large addition was made to the factory, a large power plant also being erected. It was during this period of expansion that the company began to experiment with the manufacture of hacksaw blades. The process previously used in this line of manufacture was abandoned and specially designed equipment for the automatic cutting of the teeth and tooth-setting was installed, together with special hardening and tempering equipment. New tools have also constantly been added to the line of the company's products to keep pace with the ever-changing demands of modern industry.

What is Ahead in Machine Tool Exports?

A Review of the World's Export Trade in Machine Tools and an Analysis of the Prospects for American Sales Abroad

By WALTER H. RASTALL, Chief, Industrial Machinery Division, Bureau of Foreign and Domestic Commerce

PRESIDENT Hoover and many others have repeatedly called attention to the fact that at the present juncture export business is especially important and the situation in the world market for machine tools is peculiarly interesting. *Engineering* (London) for February 7, 1930 contains an article presenting this subject from the British point of view in which the world experience of the last few years is presented in the accompanying table.

Walter H. Rastall

We have reason to believe that an index number covering the price of machine tools on a 1913 basis would approximate 190 for 1929. Correcting the above returns for 1913 on the given basis, it would mean that world shipments in that year would total about 16,700,000 pounds sterling, as expressed in 1929 currency, so that during the interval, world trade expanded about 25 per cent.

Applying the same index number to British exports, we discover that while 1929 slightly exceeded the 1913 value, exports were still about 7 per cent short of the 1913 tonnage, and for 1928 and earlier years it can be said that British exports had not yet reached pre-war levels. For 1929 the British tonnage is perhaps one per cent under 1913, while the value represents an increase of perhaps 15 per cent. Using the same methods in spite of their limitations and the fact that they may be criticized in various ways, we at least have the rough suggestion that the British prices per ton, after allowing for the change in the purchasing power of money, have increased about 25 per cent in the interval from 1913 to 1929 which may or may not prove to be an adequate measure of the technical progress represented in British designs.

Germany's Position in the Machine Tool Export Field

The accompanying table also emphasizes the rapid improvement in German exports, particularly during the period from 1925 to 1929. The British journal quoted feels that during the past year Germany has replaced the United States in leadership as a machine tool exporter. Measured by values and applying the same index numbers, it appears that Germany exported 18 per cent more machinery in 1929 than in 1913, thus, for the first time re-establishing her pre-war position. On a tonnage basis, there is reason to believe that there is an even larger margin in her favor, but if the price per ton is corrected to allow for the change that has taken place in the purchasing power of money, the German quotations are probably considerably below those of 1913, regardless of what might be said about the technical progress as represented in the designs of the machinery handled.

In this way, we have revealed from a new angle facts that have long been abundantly clear. Germany is under enormous pressure and must export. She depends upon outside sources for food for her people, raw materials for her industries, and great quantities of manufactured goods. In addition to all this, there is a heavy reparations burden and the invisible items that usually influence the balance of trade are far less favorable than in pre-war years. Germany must export to live.

International Exports of Machine Tools in Thousands of Pounds Sterling—One Pound = $4.87

Country	1913	1924	1925	1926	1927	1928	1929
United Kingdom..	1013	1326	1561	1532	1615	1770	2156*
France....	372	663	792	659	763	793	932*
Germany..	4004	2769	3816	4590	5689	6637	8990*
Switzerland.....	97	488	486	403	490	659	745*
U. S. A....	3309	3304	4568	3886	5149	7014	8460*
Total...	8795	8586	11,223	11,070	13,706	17,173	21,283

*Estimated on incomplete returns.

WALTER H. RASTALL has been Chief of the Industrial Machinery Division in the Bureau of Foreign and Domestic Commerce since Mr. Hoover reorganized that Government service about eight years ago. Previously Mr. Rastall had sold machinery in Asia for nine years—work which made it necessary for him to visit every city of importance between Yokohama and Bombay, always giving attention to the problems associated with the marketing of American machinery in the Orient in competition with European manufacturers. He has also had seven years' experience as machinery salesman in the United States. He is a graduate of Cornell University and has traveled extensively in Europe. With this wide experience as a background, and because of the privileged position he occupies in the Department of Commerce, where reports from all over the world pass over his desk daily, Mr. Rastall is peculiarly well placed to watch present trends in machinery exports and to understand the problems that arise in any foreign country in connection with the trade. He is one of the few men who are so placed as to have in proper perspective the influence of machinery on present-day civilization and to understand and solve the problems that arise in marketing industrial equipment in every land.

Great Britain is also under pressure, but differing from Germany in both kind and degree; however, these are factors that will go a long way toward explaining some of the phenomena encountered when we study the export situation.

American Export Trade in Metal-working Machinery

Translated into terms of American money, exports of metal-working machinery from the United States have been as follows:

1913	$16,097,000
1925	22,037,000
1926	18,868,000
1927	25,379,000
1928	34,125,000
1929	40,804,000

This is a very interesting picture of progress in this trade. Even after applying the index number correction as in the foregoing, it indicates that American manufacturers exported about 33 per cent more machine tool equipment last year than in 1913, which represents a greater rate of progress than shown by leading competitors, in spite of the fact that we appear to have been crowded out of the first position. In fact, we were probably crowded out of that position in 1926.

Parenthetically, a study of this table will make it quite clear that the international trade in machine tools would be much larger than it is if there had been no war. Unquestionably, that military adventure has done much to delay world progress, and a study of experience in individual countries carries the further suggestion that the trade in machinery is considerably restricted because of lack of purchasing power —that is to say, both shortage of capital and shortage of credit; and if methods could only be found to improve the credit position in a number of countries, industrial expansion, with a resulting demand for machinery, would probably be rapid and important.

Conditions in the domestic market have probably kept us so preoccupied that we have not clearly understood the influence on the machine tool business of the world financial situation, particularly during the months when call money stood at 12 per cent or higher, but now that a more normal condition has been re-established and the banks of many countries have reduced their discount rates to the usual levels, we may hope to see greater industrial development with correspondingly improved conditions, in many overseas markets.

Prices of European Machine Tools are Actually Below Pre-war Prices

Perhaps this method of using an index number to compare pre-war and post-war prices will provide a basis upon which American manufacturers can establish certain sales policies, for it may help in the various foreign markets if our manufacturers point out that European prices for metal-working machinery are below the 1913 level, making any reasonable allowance for a change in the purchasing power of money and the technical progress of the art.

About 60 per cent of American machine tool exports normally go to Europe, and in giving further attention to the export situation at this juncture, manufacturers of production tools will undoubtedly find most of their export business in the European group of countries, although manufacturers of standardized tools will perhaps find their best markets in other sections of the world. Of the European markets, the United Kingdom is most important, and absorbed nearly $7,000,000 worth of equipment last year. British imports of machine tools now stand at three times the pre-war level.

About 60 per cent of American machine tool exports go to Europe. The United Kingdom is our largest customer, France ranking second, and Germany, third. Last year, the exports to Russia came next in importance, and at present a large tonnage of American machine tools are exported to that country. The author urges American manufacturers, however, to use caution in this market, exercising much greater care in the future than in the recent past. The increasing importance of the Latin American and Far Eastern machine tool markets is also emphasized.

Experience up to the present time suggests that American manufacturers will find an important market for their products in the larger industries of the British Isles. The present indications are that British industry is in great need of overhauling and rehabilitating its factory equipment, and special measures are being taken there to provide financial support for such improvements. It would appear that the markets of the United Kingdom should prove a fertile field for sales efforts on the part of American manufacturers of production machine tools during 1930.

French, German, and Russian Markets

France ranks next in importance, and last year absorbed about $5,000,000 worth of American equipment. Here, also, conditions appear to be very favorable. French machine tool importers in 1929 absorbed three times as great a volume as in 1928. The industries of France are making rapid progress, and in spite of the fact that German and British competition is very keen in that territory, it appears that the French market will prove a fruitful one this year.

Germany ranks next having absorbed about $3,000,000 worth of equipment last year, but conditions in Germany are less favorable than in Great Britain and France, and the present indications are that the market will not prove especially fruitful until the general economic situation improves. In some ways, this is a financial problem, but other factors are also involved.

Next in importance last year was the Russian market, where a large trade is moving, but where the general situation is not entirely satisfactory, and American manufacturers are urged to handle this market cautiously, exercising much greater care in the future than in the recent past.

The other leading markets in the order of their importance are Belgium, Italy, Czecho-slovakia and Sweden, markets that undoubtedly deserve careful attention at this time. Canada and Newfoundland ordinarily absorb 20 per cent of our machine tool exports, and it is assumed that American manufacturers are reasonably familiar with conditions in these areas and have developed their own plans for further sales activities there.

The Machine Tool Exports to Latin America and Asia

The Latin American markets absorb about 10 per cent of our machine tool exports, and ordinarily do not require high-production tools, although in some instances they require a few rather large tools, particularly in railway repair shops, certain mining operations, and in the petroleum fields. In fact it is quite probable that a number of American machine tool manufacturers would like to consider again the desirability of making greater sales efforts in the oil fields of Latin America, which have been developing so rapidly during recent years. Also, Latin America is proving to be quite an important market for construction machinery, and it is probable that certain machine tool equipment may be required as an auxiliary to such operations.

The markets of Asia now absorb about 7 per cent of our machine tool exports, although as recently as 1922 they took more than 35 per cent. One concludes that Asia is hungry for industrial machinery and would absorb huge volumes of such equipment if means could be found to cover its purchase. Of course, these markets have been seriously disturbed by political considerations, which in China have reached the stage of civil war and banditry. In fact, in China it might perhaps be said that trade has declined to an irreducible minimum, and it would expand enormously if the difficulties of the existing situation could only be corrected. This statement might prove deceptive at first unless the reader realizes that China has been in this condition for several decades, and it is probably unwise to expect sudden or startling improvement. On the other hand, the situation in China undoubtedly is reflected in other countries of Asia, and world trade needs greatly a more wholesome political and economic situation in the Far East. We need to reach a position where the governments and the individual industries of these countries, as well, enjoy good credit. The machine tool industry is confronted by a huge sales problem throughout the Far East, because the Orient needs machinery, could use huge quantities of it, but has not yet come to appreciate its full significance and the ways in which it is possible to benefit from the employment of such equipment.

A Cooperative Program for Promoting Foreign Machinery Sales

In fact, apart from the sales problem of individual manufacturers, who usually concentrate their efforts on the selling of a single unit to a single customer, the machine tool industry as a whole is confronted with an important problem, for there seems to be great need to inform the people in every country of the significance of machinery in twentieth century civilization, the true meaning of what the application of machinery has done for the people of the United States, and the ways in which the same advantages might be acquired by the peoples of other countries. It would seem that the present is a time when these broad problems might be attacked cooperatively to great advantage.

From all the foregoing, it is quite clear that American interests require that greater attention be given to the export situation, not only because of conditions following on the stock market experiences of last fall, but also because of the conditions that are to be found in various countries on every continent, and further because of the threat being made on American leadership in this field. Although it is fully recognized that certain machine tool manufacturers are making very creditable sales efforts in many countries, it is still probably quite in order to say that American machine tools are "undersold" in the markets of the world.

The methods to be employed in correcting this situation are well known to a few manufacturers, and other firms interested could undoubtedly profit by following the trail blazed by these pioneers, making due allowance for the changes influencing this situation with the passage of the years. Further help in the solution of these problems can also be secured through the aid the Government departments, organized for that purpose, are able to render.

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FIFTIETH ANNIVERSARY OF THE CLEVELAND PUNCH & SHEAR WORKS CO.

The Cleveland Punch & Shear Works Co., Cleveland, Ohio, is celebrating the fiftieth anniversary of the founding of the company. This concern was established in 1880, and has grown from an organization whose products had little more than local recognition to one of the large machine tool plants of the country. While the company functions as one complete unit, there are three distinct divisions known, respectively, as the small tool division, the machine tool division, and the power press division. The small tool division was more or less an outgrowth of the machine tool division. At the beginning of the company's history, small tools, such as punches, dies, coupling nuts, etc., were furnished as part of the standard equipment of Cleveland machines. The demand for these tools became so great that the company decided to install a separate small tool division.

One of the noteworthy features in connection with this fiftieth anniversary is the length of service of some of the employes. H. J. Corrin, sales manager, entered the employ of the company in 1901 as an office boy. Three other employes, Mr. Larrimer, Mr. Walt, and Mr. Schultz, have been connected with the company for over thirty-five years, while ten others have had over twenty years' service.

Fig. 1. Toledo Press, 36 Feet High, Built in a Pit, Because of its Size

Gigantic Power Press of the Crank Type

What is believed to be the largest press of the crank type ever built has recently been constructed by the Toledo Machine & Tool Co., Toledo, Ohio. This press, which is shown in Fig. 1, is used for heavy blanking, forming, and piercing operations in the manufacture of large truck rails and for other work of similar nature. An idea of the huge proportions of the castings used in this machine may be obtained by comparing the size of the machine and that of the man standing nearby in each of the illustrations.

The total weight of the press is approximately 800,000 pounds, the crown connecting the two housings and the slide each weighing approximately 130,000 pounds. Two large steel spur gears, one on each end of the crankshaft, are 140 inches in

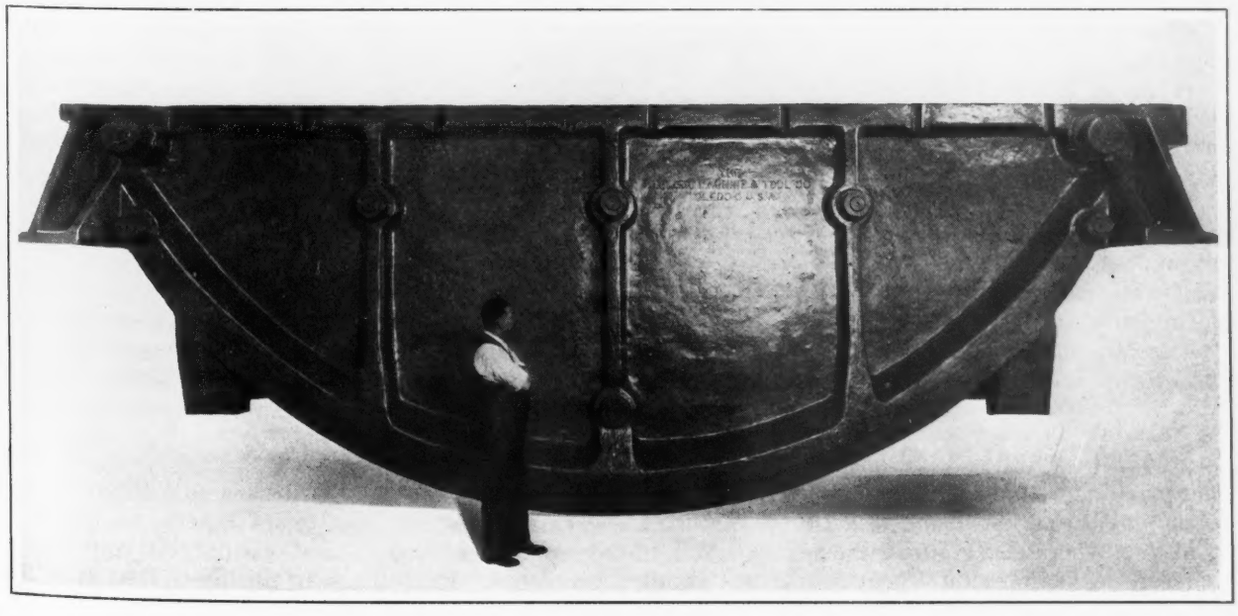

Fig. 2. The Massive Construction of the Press Bed is Evident from this Illustration

diameter and have an 18-inch face. The bed, weighing 300,000 pounds, is 24 feet long and nearly 6 feet wide. When the slide is at the bottom of the stroke, a pressure of 3,500,000 pounds is exerted. Because of the great height of this press—36 feet—it was necessary to build it in a pit with the table level below the floor line; however, in actual operation, it will not need to be so located.

Owing to the great weight of the moving parts, the slide is carefully counterbalanced by means of four air cylinders, two of which may be seen attached to the crown in Fig. 1. This method of counterbalancing insures smooth running of the slide, the latter operating at seven strokes per minute. The press is controlled by the Toledo patented multiple disk friction clutch with an independent brake, which enables the operator to stop and start the press at any part of the stroke. The flywheel is mounted on Timken roller bearings and is the only part in motion when the press is not in operation. The clutch mechanism is controlled by compressed air through a valve located in a convenient position at the front of the press.

For cases of emergency and for setting dies, a hand-lever is provided to control the movement of the slide, the air-valve lever being in a neutral position. A 150-horsepower motor mounted at the rear of the right-hand housing and belted to the flywheel furnishes the necessary power, while a motor mounted at the front of the press is provided for adjusting the slide.

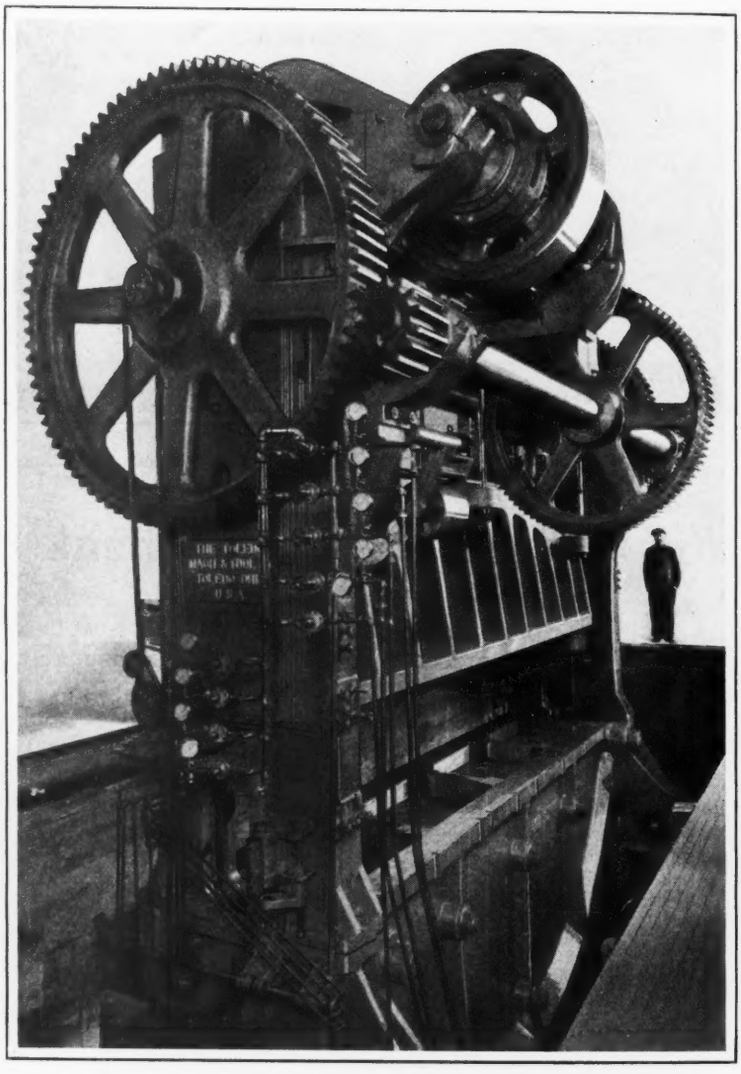

Fig. 3. Another View of the Press, Showing the Pit in which it was Erected

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The machinery and metal industries of Switzerland employ 115,000 workmen in 1700 factories. In addition, there are 1100 factories engaged in watch making, employing 48,000 workers. In all, 23,000,000 watches were exported from Switzerland in 1929.

METAL TRADES ASSOCIATION TO MEET IN NEW YORK

The thirty-second annual convention of the National Metal Trades Association will be held at the Hotel Astor, New York City, April 16 and 17. L. F. Loree, president of the Delaware & Hudson Co., Samuel A. Lewisohn, vice-president and treasurer of the Miami Copper Co. and chairman of the Board of the American Management Association, and E. K. Hall, vice-president of the American Telephone & Telegraph Co., will present the problems of their industries and the steps they are taking to meet the problems of stabilization of employment. A joint meeting with the National Industrial Conference Board, to be held April 17, will place the representatives from the 1100 member manufacturers in the automobile, machine tool, general machine building, radio, and other metal trades industries in closer touch with the important trends in American industry as a whole.

The committee on industrial relations will make superannuation the chief feature of its report. Savings in compensation insurance premiums through cooperation with insurance companies will be emphasized in the report made by the committee on the prevention of industrial accidents. The committee on industrial education will present its accomplishments in foremanship training and the progress made on its new apprentice training course. The annual banquet on April 16 will conclude the convention.

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Stainless steel has been used to a limited extent in machine tools for parts that are exposed to dampness or water and cannot be conveniently protected. By the use of stainless steel it is possible to prevent these parts from rusting or corroding.

The British Metal-working Industries

Industry in General is Suffering a Temporary Set-back, but Activity Continues in the Machine Tool Field

From MACHINERY'S Special Correspondent

London, March 18

THROUGHOUT the metal-working industries, conditions are inclined to be quiet. On all sides the explanation given is the same, namely, that a waiting policy has perforce been adopted until the terms of the Budget are made known. This will be presented next month, and manufacturers will then know where they stand. In some quarters, the opinion is held that trade is at the beginning of another decline and that the highest point of renewed prosperity was reached during the middle of last year. This is a view to which we cannot subscribe. It is true that unemployment is increasing, but this is undoubtedly one of the immediate effects of the important schemes of rationalization that are proceeding in many branches of industry, and of which the full benefit has not yet been felt.

That there is no lack of confidence is evident from the support given by manufacturers to the heavy section of the British Industries Fair held recently at Birmingham, and the majority of firms who exhibited appear to be well satisfied with the resulting orders.

The Machine Tool Industry Remains Active

If further evidence is wanting that manufacturers throughout the metal-working industries regard the present set-back as being of a wholly temporary nature, it is surely provided by the continued activity of the machine tool industry. It is true that in certain cases machine tool makers have experienced some falling off in inquiries and orders during recent weeks, but there are few that are not well employed, and many are still working overtime. This state of affairs is quite incompatible with the view that industry is passing through the initial stages of a long period of depression.

Overseas Trade in Machine Tools

In January the exports of machine tools showed but little variation from the monthly average for 1929, the tonnage being 2 per cent higher, the value 0.25 per cent higher, and the ton value a little lower; thus the expansion that took place in 1929 has just been maintained.

Imports during January exceeded the average for last year in both tonnage and value. Since 1924, imports of machine tools have increased fourfold in both tonnage and value, and there is nothing to indicate that this period of rapid expansion is drawing to a close.

During January the actual tonnage of machine tools exported was 1382, as compared with 1176 tons in December, and 1480 tons in November, the corresponding values being £180,026, £160,919 and £187,491, respectively. The January imports totaled 1220 tons, as against 1008 tons in December, and 969 tons in November, the total values of imports for the three months in the order given being £186,488, £164,963, and £165,624. An inspection of the import and export curves for the last twelve months indicates how rapidly the former are overtaking the latter.

The Automobile Industry is Quiet

While some of the larger automobile manufacturers are comparatively well employed, throughout the industry as a whole the usual seasonal activity is conspicuous by its absence. Clearly both manufacturers and buyers are marking time until the intentions of the Government with regard to the McKenna duties, the horsepower tax, and the gasoline tax are revealed. The cautious attitude that has resulted is having an adverse effect on those trades that supply the automobile industry, which are usually very busy at this time of the year.

Railway engineering firms continue to be well employed on the whole, their activity being attributable in part to the progressive policy that has been adopted by the important home railway companies, while in addition there is a steady flow of orders from overseas.

* * *

EXPORTS OF INDUSTRIAL MACHINERY AGAIN INCREASING

The exports of American industrial machinery reached the record figure of $257,000,000 in 1929, with a monthly average of nearly $21,500,000. Toward the end of 1929 the monthly volume of exports declined, but turned again sharply upward in January, 1930, reaching a total of $23,336,000. This total exceeds that for December by nearly 20 per cent and for January, 1929, by 14 per cent. Nearly every important class of machinery showed substantial gains, especially oil-well and refinery machinery, mining and quarrying machinery, and construction and conveying equipment. Metal-working machinery was exported to a value of $3,861,000 in January, 1930, as compared with $3,118,000 in the corresponding month last year. Drilling machines, universal grinding machines, tool and cutter grinding machines, vertical boring mills, and chucking machines were especially prominent in the list of exports. The exports of forging machinery increased to a marked extent.

Prize Competition—Articles on Tools and Fixtures

MACHINERY offers fifteen prizes for the fifteen best articles describing unusual tools, jigs, fixtures, dies, gages, inspection devices, or measuring instruments employed in machine shop work to insure accuracy and increase production. The prizes are as follows:

Two prizes.....	each $50	in addition
Four prizes.....	each 30	to regular
Nine prizes.....	each 20	space rates

MACHINERY'S regular space rates will be paid not only for the prize-winning articles, but also for any articles accepted for publication that may not receive a prize.

Each contestant may submit as many articles describing different tools or devices as he wishes. All articles submitted will be entered in the competition, and all may be accepted for publication, but no contestant will be awarded more than one prize.

Articles entered in this competition should be addressed to the Editor of MACHINERY, 148 Lafayette St., New York City. They must be mailed on or before May 1.

Preparing Articles for the Competition

This competition applies to any special tools, jigs, fixtures, dies, gages, inspection devices, or measuring instruments that have been designed for a specific purpose to facilitate the work in a machine shop. Standard tools and devices regularly made for the market are not eligible, nor can a description of a device be accepted for the competition if the design has been described previously.

The competition is open to all, whether subscribers to MACHINERY or not. The general procedure in preparing an article for the competition is very simple:

1. Send a drawing or blueprint of the tool (or photograph if preferred—or both) that clearly shows all important parts of the device.
2. Describe as clearly as possible the purpose for which the device is designed and its action, or how it is used; state also, as far as possible, the advantages gained by the use of the tool, giving production figures, when available.
3. Mark the important parts of the drawing, such as clamps, levers, etc., with letters *A*, *B*, etc., and use corresponding letters to identify these parts in the description; thus: "Clamp *A* is held down by lever *B*, the end of which is cam-shaped." This will help to make the description readily understandable.
4. Confine each article to one separate device.

Suggestions about Illustrations and Manuscripts

Clear blueprints or pencil drawings with distinct lines are satisfactory. They should be made on sheets of paper separate from the description. Send only drawings that are made to scale, with the various parts shown in correct relationship and proportion. Rough, free-hand sketches cannot be used. The drawing must show the assembled tool, fixture, die, or gage, although a diagrammatic drawing may often be substituted to advantage, especially if it illustrates more clearly the arrangement of the important parts of a complicated tool.

It is more essential that important facts be clearly stated than that the manuscript be neatly written; but carefully prepared manuscripts usually indicate careful thought.

New Process for Finishing Metal

The preparation of heat-treated metallic parts for subsequent operations, such as grinding, polishing, and electroplating, is the purpose of a new process for metal finishing which is a recently announced development of the Bullard Co., Bridgeport, Conn. This process can also be applied to the finishing of metal for intricate mechanisms wherein scale or metallic oxides, freed from the parts by vibration or impact, might become mixed with lubricants and thus form a destructive abrasive.

A remarkable reduction in cost and a speeding up of production in the metal fabricating industries are advantages claimed for this new development, which is known as the Bullard-Dunn process. It is said that an entirely new principle in electro-chemistry is employed, which accomplishes, by the use of an electro-chemical bath, those metal-finishing functions that have heretofore been possible only by sand-blasting and pickling. The process is the result of four years of research work and practical tests in the removal of scale and metallic oxides formed in the heat-treatment of metals. It does not pit the surface of the metal, and thus eliminates the necessity for refinishing. It is also said to render the product semi-rust resisting and to eliminate the danger of hydrogen-embrittlement. It produces a surface that is not only resistant to corrosion, but that forms an ideal surface for the subsequent electro-deposition of metals such as nickel, copper, and chromium.

A motor-generator set and suitable tanks are practically the only equipment required. It is of interest to note that in some instances a reduction of 75 per cent in the labor required for polishing stainless steel has been effected by employing the Bullard-Dunn process. In one case, stainless steel is now given the desired polish by two grinding operations after applying this process, whereas eight grinding operations were previously required. An interesting application of the process has been made to the finishing of the inner surfaces of long lengths of pipe, such as electric cable conduits.

POWER REQUIRED FOR DRILLING—2*

Data Based Upon the Use of Sharp Twist Drills and a Coolant Consisting of One Part of Soluble Oil and Sixteen Parts of Water

Material and Heat-treatment	Hardness of Material			Drill Diam., Inches	Drill Feed, Inch per Rev.	Drill Speed, R.P.M.	Torque, Ft.-Lbs.	Thrust in Pounds	Horse-power at Drill Point
	Brinell No.	Rockwell B Scale	Scler-oscope						
Steel S.A.E. 3135 Normalized at 1575 Deg. F. Annealed at 1500 Deg. F.	192	88.5	29	1/2	0.009	446	10.4	647	0.89
				5/8	0.011	371	17.5	813	1.25
				3/4	0.012	298	26.3	1200	1.50
				1	0.013	228	50.8	1683	2.21
				1 1/4	0.015	176	88.0	2100	2.96
				1 1/2	0.015	151	117.0	2600	3.38
Steel S.A.E. 6150 Normalized at 1650 Deg. F. Annealed at 1550 Deg. F.	187	86.5	29	1/2	0.009	444	14.9	725	1.19
				5/8	0.011	368	22.3	838	1.57
				3/4	0.012	299	34.3	1269	1.97
				1	0.013	228	62.4	1862	2.72
				1 1/4	0.015	175	110.8	2430	3.71
				1 1/2	0.015	149	143.3	3000	4.10
Steel S.A.E. 3250 Normalized at 1650 Deg. F. Annealed at 1475 Deg. F.	207	92.5	30	1/2	0.009	445	12.4	728	1.06
				5/8	0.011	369	20.5	875	1.45
				3/4	0.012	298	31.9	1363	1.82
				1	0.013	227	59.0	2137	2.57
				1 1/4	0.015	179	109.4	2988	3.76
				1 1/2	0.015	150	143.1	3225	4.13
Steel S.A.E. 3140 Normalized at 1650 Deg. F. Annealed at 1500 Deg. F.	196	92	30	1/2	0.009	446	10.9	693	0.93
				5/8	0.011	369	18.8	831	1.33
				3/4	0.012	298	28.0	1152	1.60
				1	0.013	227	52.4	1741	2.28
				1 1/4	0.015	176	88.0	2474	2.97
				1 1/2	0.015	150	122.3	2740	3.52
Steel S.A.E. 2330 Annealed at 1500 Deg. F. Reannealed at 1400 Deg. F.	202	93.3	32	1/2	0.009	445	12.6	776	1.07
				5/8	0.011	371	21.0	910	1.49
				3/4	0.012	298	32.3	1425	1.85
				1	0.013	227	60.5	2290	2.63
				1 1/4	0.015	179	101.6	3500	3.49
				1 1/2	0.015	150	140.0	3800	4.00
Steel S.A.E. 2340 Annealed at 1500 Deg. F. Reannealed at 1400 Deg. F.	207	93.5	32	1/2	0.009	445	12.7	754	1.08
				5/8	0.011	370	20.7	904	1.47
				3/4	0.012	298	32.5	1492	1.86
				1	0.013	227	62.5	2758	2.72
				1 1/4	0.015	174	103.4	3600	3.45
				1 1/2	0.015	150	145.0	3800	4.16

*Data from paper on "Power Required to Drill Cast Iron and Steel," by O. W. Boston and C. J. Oxford, presented at the annual meeting of the American Society of Mechanical Engineers, December, 1929.

MACHINERY'S Data Sheet No. 176, New Series, April, 1930

POWER REQUIRED FOR DRILLING—1*

Data Based Upon the Use of Sharp Twist Drills and a Coolant Consisting of One Part of Soluble Oil and Sixteen Parts of Water

Material and Heat-treatment	Hardness of Material			Drill Diam., Inches	Drill Feed, Inch per Rev.	Drill Speed, R.P.M.	Torque, Ft.-Lbs.	Thrust in Pounds	Horse-power at Drill Point
	Brinell No.	Rockwell B Scale	Scler-oscope						
Cast Iron (Charcoal) No Heat-treatment	163	83	32	1/2	0.009	446	6.3	530	0.54
				5/8	0.011	364	10.2	645	0.71
				3/4	0.012	300	15.7	803	0.90
				1	0.013	230	27.9	1087	1.23
				1 1/4	0.015	179	46.4	1403	1.60
				1 1/2	0.015	153	65.9	1700	1.94
Cast Iron (Regular) No Heat-treatment	143	76	30	1/2	0.009	446	6.0	500	0.51
				5/8	0.011	364	10.0	621	0.70
				3/4	0.012	302	15.6	760	0.90
				1	0.013	230	27.7	1006	1.22
				1 1/4	0.015	179	43.3	1270	1.49
				1 1/2	0.015	153	63.0	1517	1.85
Steel S.A.E. 1020 No Heat-treatment	137	84	29	1/2	0.009	442	11.5	626	0.97
				5/8	0.011	368	19.4	732	1.34
				3/4	0.012	298	29.2	910	1.67
				1	0.013	228	54.0	1415	2.35
				1 1/4	0.015	176	87.9	1900	2.96
				1 1/2	0.015	150	120.0	2150	3.46
Steel S.A.E. 1045 Normalized at 1600 Deg. F. Annealed at 1475 Deg. F.	159	82	28	1/2	0.009	445	11.0	636	0.94
				5/8	0.011	368	19.6	762	1.38
				3/4	0.012	298	29.1	959	1.66
				1	0.013	228	54.0	1490	2.45
				1 1/4	0.015	176	93.0	2000	3.13
				1 1/2	0.015	150	127.0	2300	3.77
Steel S.A.E. 2320 Annealed at 1600 Deg. F.	163	85.5	25	1/2	0.009	446	11.0	618	0.94
				5/8	0.011	368	18.7	728	1.32
				3/4	0.012	298	27.7	1027	1.58
				1	0.013	228	51.3	1615	2.23
				1 1/4	0.015	176	86.1	2058	2.90
				1 1/2	0.015	151	118.0	2506	3.54
Steel S.A.E. 3120 Annealed at 1600 Deg. F.	143	75	24	1/2	0.009	446	11.0	571	0.94
				5/8	0.011	368	18.6	673	1.31
				3/4	0.012	298	27.9	912	1.59
				1	0.013	228	51.3	1500	2.23
				1 1/4	0.015	176	87.0	1838	2.93
				1 1/2	0.015	151	118.4	2155	3.42

*Data from paper on "Power Required to Drill Cast Iron and Steel," by O. W. Boston and C. J. Oxford, presented at the annual meeting of the American Society of Mechanical Engineers, December, 1929.

MACHINERY'S Data Sheet No. 175, New Series, April, 1930

New Shop Equipment

A Monthly Record of the Latest Developments in Metal-working Machinery, Small Tools, and Work-handling Appliances

LE BLOND AUTOMATIC CRANKSHAFT LINE-BEARING LATHE

A hydraulic lathe designed for turning the line bearings of automobile crankshafts, and the stub and flange ends as well, has been added to the line of production equipment built by the R. K. Le Blond Machine Tool Co., Cincinnati, Ohio. This machine, which is known as the 5-ACL, is built with either a double-end drive, as shown in Fig. 1, or with a center drive, as illustrated in Fig. 2. One of these double-end drive machines, together with one of the center drive type, and a 5-AC pin-turning lathe will machine an eight-throw crankshaft with nine line bearings. The pin-turning machine was described in January, 1929, MACHINERY.

The crankshafts come to the double-end drive machine centered and with locating spots milled on the webs. In this machine, the crankshaft is driven by the air-operated pot chucks shown. These chucks are mounted on heavy spindles that run in Timken roller bearings. The chucks are of an equalizing design that makes it impossible to spring the crankshaft when chucking it. This machine turns the four intermediate line bearings.

The next operation is performed in the center-drive machine in which the work is gripped on the web by two equalizing clamps, the crankshaft being located from the previously turned intermediate line bearings. In this machine, the crankshaft is driven by both center units, a feature which reduces torque on the work to a minimum, since the load is practically the same on both units. The drive is through ring gears which mesh with pinions mounted on

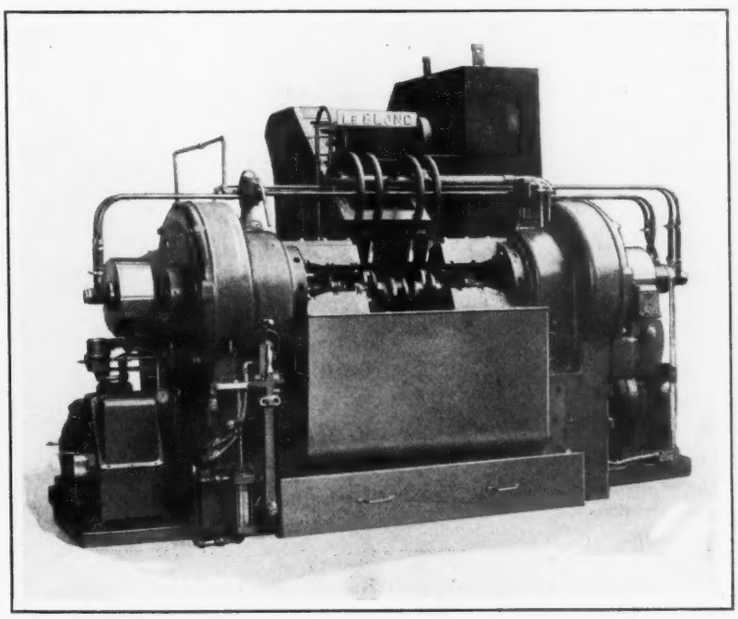


Fig. 1. Le Blond Double-end Drive Lathe which Finishes the Four Intermediate Line Bearings of Eight-throw Crankshafts Simultaneously

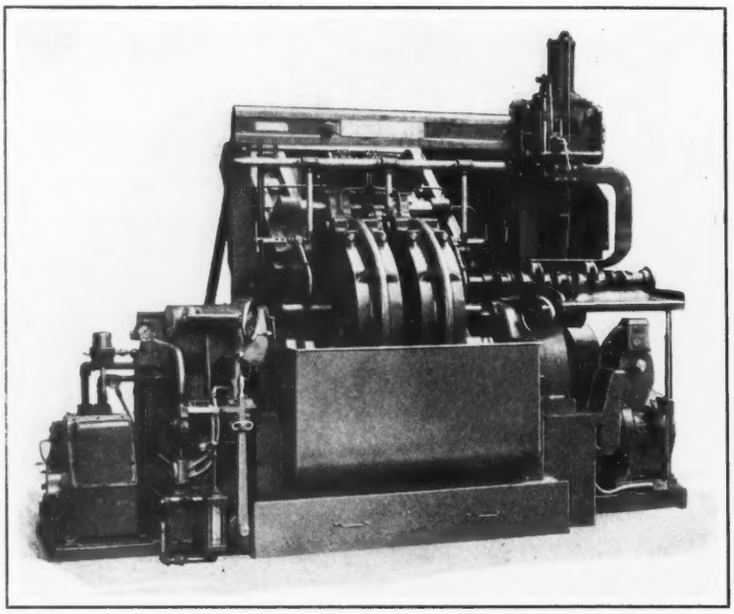


Fig. 2. Le Blond Center-drive Lathe which Machines the Remaining Line Bearings and the Stub and Flange Ends of Crankshafts

a large splined shaft. This drive shaft runs in Timken bearings and is driven by a gear meshing with the motor pinion.

The tools of both machines are actuated in an identical manner by a hydraulic cylinder located in a compartment in the center of the machine. From this cylinder, motion is transferred through a rack and segment to a shaft which, in turn, actuates the tool-bars by means of a toggle arrangement. With a given piston speed, the speed of the tools automatically decreases as they approach the end of the cut. The front and rear tools feed toward each other, thus reducing to a minimum the tendency of the crankshaft to spring.

In order to insure the accurate reproduction of crankshafts to the same sizes, án arm on the segment is arranged to strike a positive stop. When this occurs, the piston motion is stopped, the pressure is built up in the cylinder to a predetermined point and a relief valve by-passes the oil into a small pot cylinder which trips the Oilgear control and allows the Oilgear pump to be reversed and the machine spindle to be stopped. The spindle is stopped in a predetermined position by means of a dynamic control switch. The hydraulic equipment is stopped by a cam when the tool-bars have returned to the loading position.

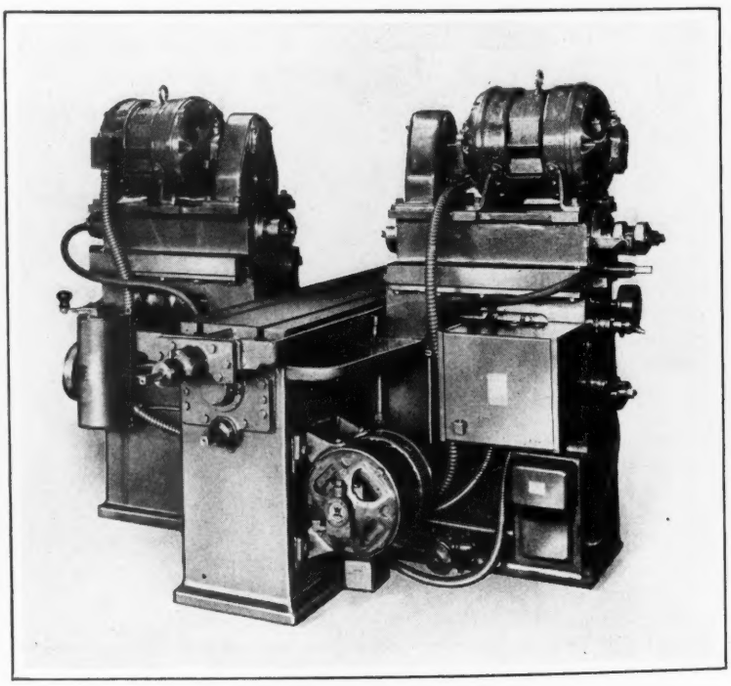
Tools of the vertical bit type are used, so that it is possible to remove and replace them without changing the diameter setting of the machine. The front tools rough-face the webs and finish-turn the bearings, while the rear tools do the cheeking and finish-face the webs.

In operating the double-drive machine, the crankshaft is placed in the pot chucks, located with the air-operated center, and then clamped by the chucks. The motor control switch is next pressed to the starting position, and when released, it automatically drops back to the running position. The traverse is then engaged. The tools traverse to the work, feed to the proper depth, and then return to the starting position, whereupon the spindle stops automatically. The air valves are then closed and the finished crankshaft removed.

The operation of the center-drive machine is the same, except for the loading, which consists of placing the crankshaft on a carrier, as shown at the right in Fig. 2, and moving it between the centers. The carrier is then removed, the centers adjusted, and the clamps locked.

STAMETS AUTOMATIC SPLINE-MILLING MACHINE

An automatic spline-milling machine for handling large work has been developed recently by William K. Stamets, Jenkins Arcade Bldg., Pittsburgh, Pa.



Stamets Heavy-duty Spline-milling Machine

The two opposed spindles are mounted in roller bearings and driven by separate two-horsepower motors. Four spindle speeds are available. The table feed-screw is directly connected by a silent chain and speed-changing device to a two-horsepower motor.

The length of the table stroke is controlled by a positive stop on the feed-screw dial plate. The reverse traverse movement is obtained by reversing the motor. There is a dwell at the end of the table travel which permits setting the machine for a deep infeed. An electric control stops the spindle when the required depth of feed has been reached, as determined by the setting of a vernier scale.

The machine has a capacity for cutting through slots in bars up to 9 inches in diameter and single keyways in shafts up to 15 inches in diameter. The maximum distance between the spindle ends is 26 inches, and the minimum distance, 4 inches. The maximum total spindle infeed is 5 inches. The working surface of the table is 66 by 14 inches. The table travel is 24 inches, and the speeds range from 4 to 20 inches per minute.

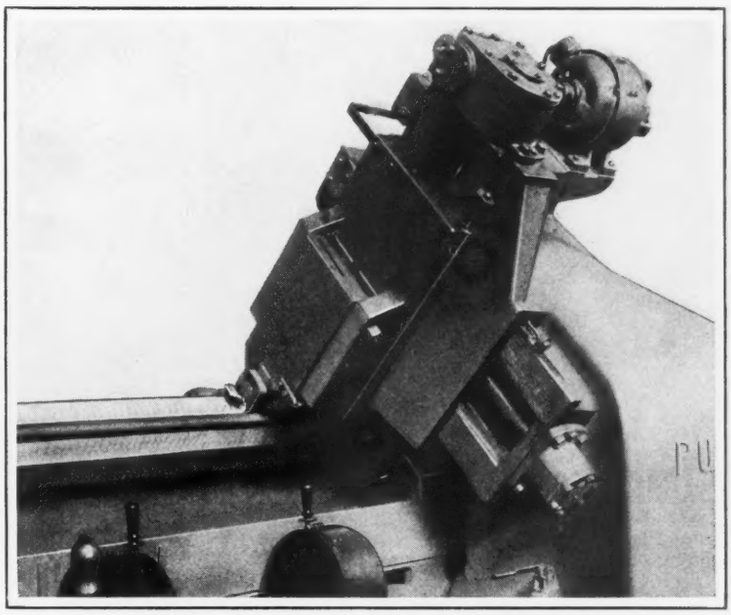


Fig. 2. Close-up View of Tool-head Used on Machine Shown in Fig. 1

PUTNAM SQUARE BILLET GOUGER

Surface defects on square billets originating from the pouring and cooling of the ingot and defects produced in rolling can be removed with great rapidity by a machine known as the "square billet gouger" recently developed by the Putnam Machine Works Division of Manning, Maxwell & Moore, Inc., of Fitchburg, Mass. This machine is designed to approximate, as nearly as possible, the actual operation of chipping with a hand-guided chisel, but to accomplish this work at a speed from ten to forty times faster than when performed by hand. With this machine it is possible to peel square billets at a speed more nearly approaching that obtained in handling round billets with the "billet peeler" that was previously placed on the market by this company.

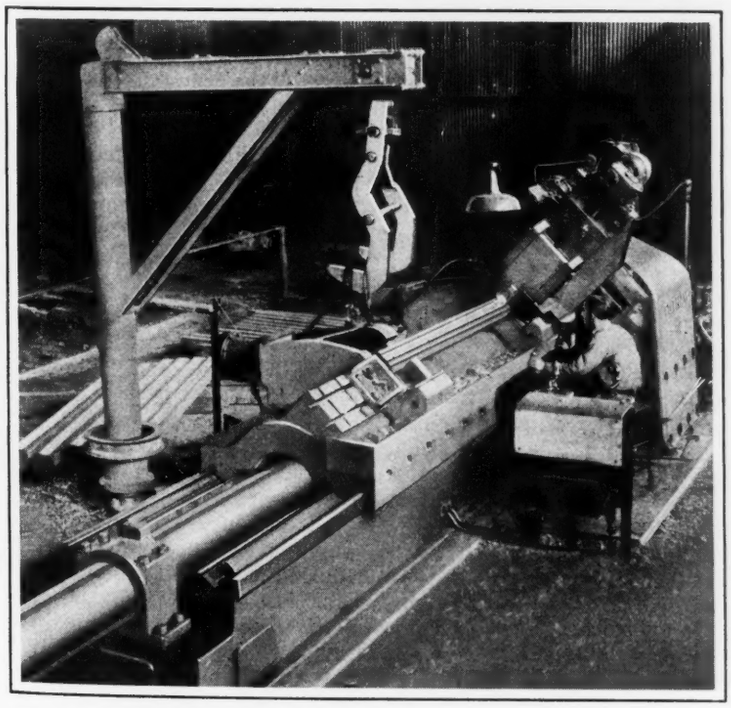


Fig. 1. Putnam Square Billet Gouger in Operation

The square billet gouger is of the planer type, but its operation differs from that of an ordinary planer in that the depth of cut can be kept uniform regardless of the camber or bends which exist in the billet. The operator has complete and instant control over the cutter, so that he can remove the surface defects from the billet exactly as they would be removed by methods previously employed. Thus the tool can be made to follow any camber, crack, or seam in the billet almost as readily as if it were held directly in the hand. The depth of cut is determined at all times by the operator, and is not affected by any irregularities in

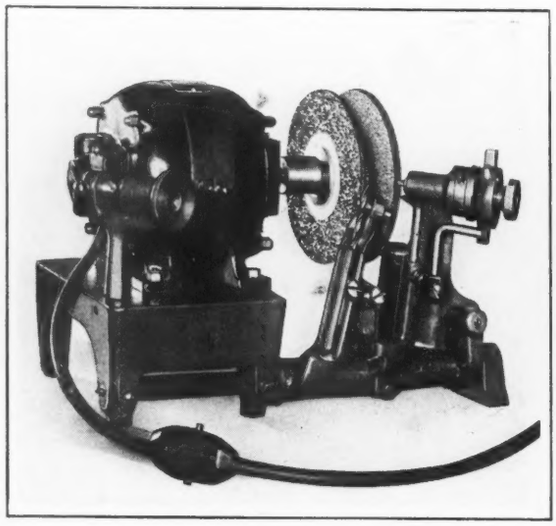


Fig. 1. Wells Drill Sharpening Machine

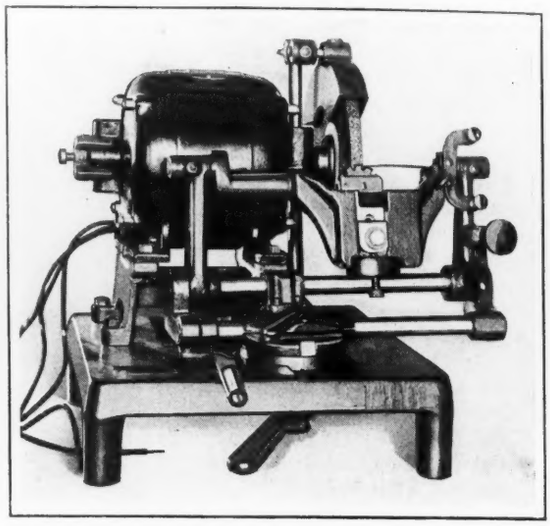


Fig. 2. Machine for Sharpening Convex Cutters

the billet. In recent tests, billets 6 by 6 inches square by 10 feet 6 inches long have been planed all over in twelve minutes floor to floor time.

The billet is clamped on a table actuated by a hydraulic drive, which moves from left to right during the cutting stroke. Cutting speeds up to 30 feet per minute and a return speed of approximately 50 feet per minute are available. The drive is controlled by foot-treadles, pressure of the right foot causing the table to move in the cutting direction, while pressure of the left foot reverses the direction of table movement. Both hands of the operator are left free to control the inward or crosswise movements of the tool. A separate indexing device serves to turn the billet through an angle of 90 degrees in order to bring a new face into the operating position.

The tool-head of the machine shown in Fig. 2 is instantly responsive to the operating or control handles, which give it movements in two directions, namely, in and out of the cut and across the face of the billet. The operating handles simply control the motors that actuate the tool-head. These motors are mounted on the tool-head. The ways of the table are lubricated by force feed from an oil tank cast in the bed of the machine. A separate motor and oil-pump are employed for this lubricating system. The remaining bearings of the machine are lubricated by a pressure grease system.

WELLS MOTOR-DRIVEN MACHINES FOR SHARPENING DRILLS AND CUTTERS

The drill and convex milling cutter sharpening machines illustrated in Figs. 1 and 2, respectively, are recent developments of the Wells Mfg. Co., Greenfield, Mass. The drill sharpening machine is driven by a 1/6-horsepower, 110- or 220-volt electric motor. This machine is designed for sharpening drills 1/4 inch in diameter and smaller. The drill to be ground is mounted in a draw-in chuck which is held in a quill. After the drill has been lightly gripped in the chuck the quill is slid into the "lining-up" holder shown at the left of the machine which fixes the drill in the correct position. The drill and quill are then inserted in the grinding fixture shown at the right.

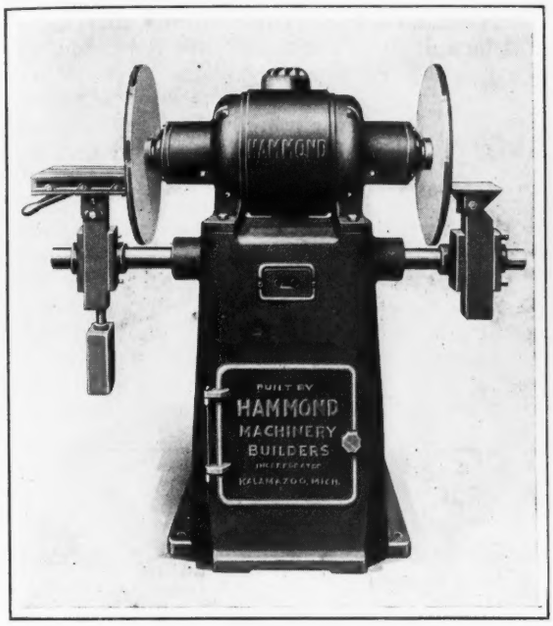
This fixture has a cam which produces a "swing" motion designed to sharpen the drill correctly and quickly. The drill is held in a fixture for correctly thinning the point on a thin emery wheel. A diamond for truing the wheels and a rack for holding the spring chucks are included with the equipment.

The machine shown in Fig. 2 is designed for grinding convex circular cutters having teeth formed for milling half circles or arcs of circles. The machine will handle any cutter from 1/8 to 1/2 inch in thickness and from 2 to 4 inches in diameter. A fixture can be used for the larger cutters.

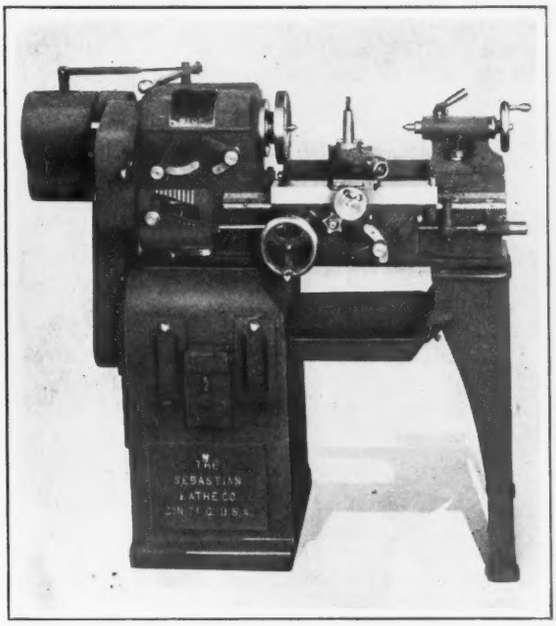
The cutter to be ground is mounted on the trunnion holder. By swinging this holder on its trunnions the cutter teeth are ground to the required radius. The indexing guide is in contact with the tooth being sharpened. The machine is driven by an alternating- or direct-current, 110- or 220-volt motor. A diamond is supplied with the machine for truing the grinding wheel.

HAMMOND DOUBLE-DISK GRINDERS

A double-disk electrically driven grinder in sizes of from 3 to 10 horsepower, with disks from 12 to 24 inches in diameter, is being placed on the market by the Hammond Machinery Builders, Inc., 1604 Douglas Ave., Kalamazoo, Mich. The disks of this grinder are machined on both sides and are reversible, so that when one side becomes worn, the disk can be reversed,



Hammond Grinder Equipped with Reversible Double Disks



Sebastian Heavy-duty Sixteen-speed Geared-head Lathe

thus doubling the number of service hours.

The grinder is driven by a totally enclosed motor, and is provided with an air cleaner which permits only clean cool air to be drawn through the windings. The motor is designed with a high overload capacity and operates at less than a 40-degree temperature rise. The push-button control is conveniently mounted in a recess at the front of the pedestal. A Cutler-Hammer automatic starter with overload protection, low-voltage protection, and phase failure protection is mounted on the door of the pedestal. One plain table and one table equipped with a lever-feed, as shown in the illustration, are provided as standard equipment.

SEBASTIAN HIGH-SPEED LATHE

The 11-inch heavy-duty lathe recently added to the line of "Gold Seal" lathes built by the Sebastian Lathe Co., 106 Culvert St., Cincinnati, Ohio, is of the same general design as a previous model, described in July, 1929, MACHINERY, page 874. It has several new features, however, that make it particularly suited for school purposes and for a wider range of production work. The two shafts and the spindle of the lathe head are equipped with Timken bearings. Other improvements include a wider range of speeds, eight speeds ranging from 26 to 620 revolutions per minute being furnished by the geared head when a single-speed motor is used. With a two-speed motor, sixteen speeds, ranging from 19 1/2 to 930 revolutions per minute, are available. Steel gears are used throughout, and a safety shear pin is incorporated in the design.

The lathe is supplied with a tumbler reverse plate for use in cutting left-hand threads. The thread cutting range is from 6 to 96 threads per inch, and the feeds range from 0.00175 to 0.111 inch. The bed lengths available are 3, 4, 5, 6 and 8 feet. A one-horsepower motor having a speed of 1200 revolutions per minute operates the lathe through a silent chain drive.

OXWELD BLOWPIPE AND WELDING ROD

A Type W-17 blowpipe similar in design to the Type W-15 aircraft welding blowpipe described in March, 1929, MACHINERY, page 553, has recently been brought out by the Oxweld Acetylene Co., 30 E. 42nd St., New York City. The Type W-17 blowpipe, however, is of full size construction and large enough for any welding job. It is of the injector type, and can be used on a low-pressure acetylene supply, the same as the other types of blowpipes manufactured by this company.

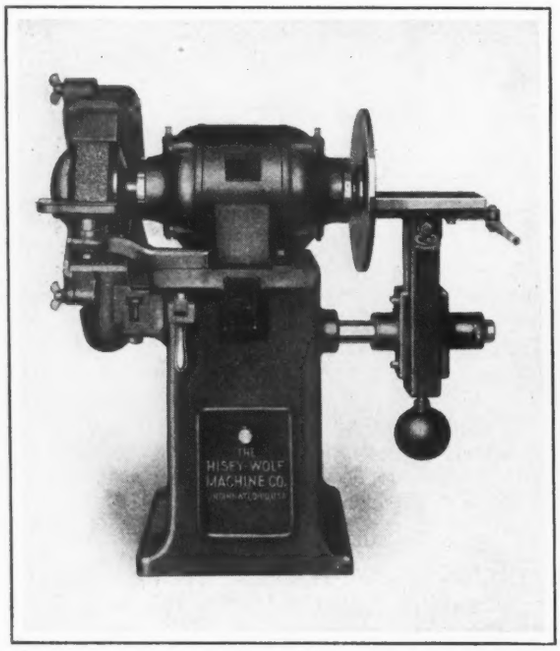
The inner cone of the flame obtained with this blowpipe is shorter and thicker than that of other types. It also has a tendency to assume the shape of a ball at the end, a feature which is claimed to speed up the rate of welding, because it brings a larger portion of the high-temperature flame closer to the metal. The tip and welding head are of one-piece construction, being combined in a long and slender stem of the gooseneck type.

For producing full-strength welds in 0.30 to 0.40 per cent carbon steel, this company has brought out a welding rod known as "Oxweld No. 22 S.D." The two letters "S.D." of this designation refer to two qualities which the rod is designed to impart to the weld; namely strength and ductility. This rod was designed especially to meet the demand for joints of maximum

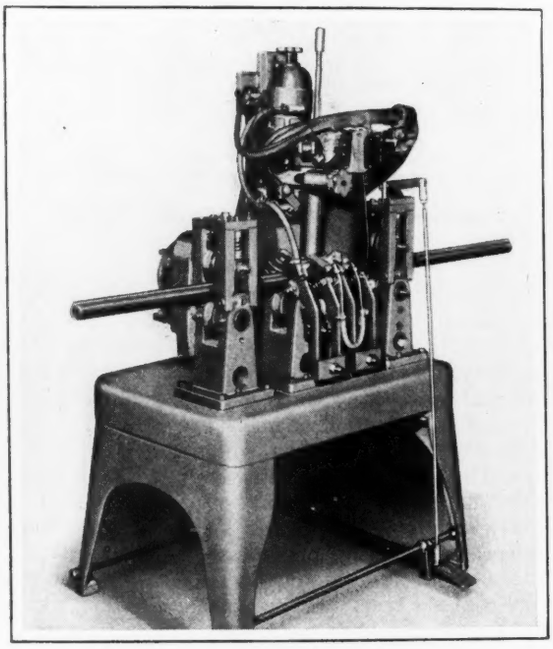
strength in steel pipe having a carbon content of from 0.30 to 0.40 per cent, such as has recently come into use. It is available in 3/16-inch and 1/4-inch diameters, and in 36-inch lengths.

HISEY-WOLF COMBINATION DISK AND FLOOR STAND GRINDER

A five-horsepower combination disk and floor stand grinder of heavy construction has recently been brought out by the Hisey-Wolf Machine Co., Colerain Ave. and Marshall St., Cincinnati, Ohio. The spindle is mounted in ball bearings, and is equipped with a 20-inch diameter steel disk at one end and an 18-inch by 3-inch grinding wheel at the other end. The regular equipment includes a safety combination wheel guard, disk, and work-table, as shown in the illustration. The five-horsepower motor has a no-load speed of 1140 revolutions per minute, and is controlled by an automatic safety motor starter. The diameter of the grinding wheel arbor is 1 1/2 inches, and the over-all length of the spindle, 42 inches. The base of the machine measures 20 by 21 inches; the height from the floor to the center of the spindle is 36 inches; and the weight, 1300 pounds.



Hisey-Wolf Five-horsepower Combination Grinder



Lincoln Automatic Seam-welding Machine

LINCOLN SEAM-WELDING MACHINE FOR TUBULAR BRAKE SHAFTS

An automatic machine intended for use in the manufacture of brake cross-shafts by the application of the carbon arc welding process has recently been brought out by the Lincoln Electric Co., Coit Road and Kirby Ave., Cleveland, Ohio. This machine is designed to weld a longitudinal seam across the shafts as they come from the press on which they are formed. The shafts are fabricated from 1/8-inch plate, and are formed into a tube 1 1/4 inches in diameter by 36 inches long. These tubes have two edges bent perpendicular to the circumference and adjacent to each other, which are fused together on the welding machine as they pass automatically under the arc. The shafts are fed through the machine under the stationary electrode at the rate of 36 inches per minute. The electrode, which forms one end of the arc, is fed down at the proper speed to maintain a uniform arc and the shaft progresses at the correct welding speed. When the proper speeds have once been determined, it is only necessary to place the shaft in position and start the arc. No filler rod, such as is generally used in automatic welding, is necessary for this job.

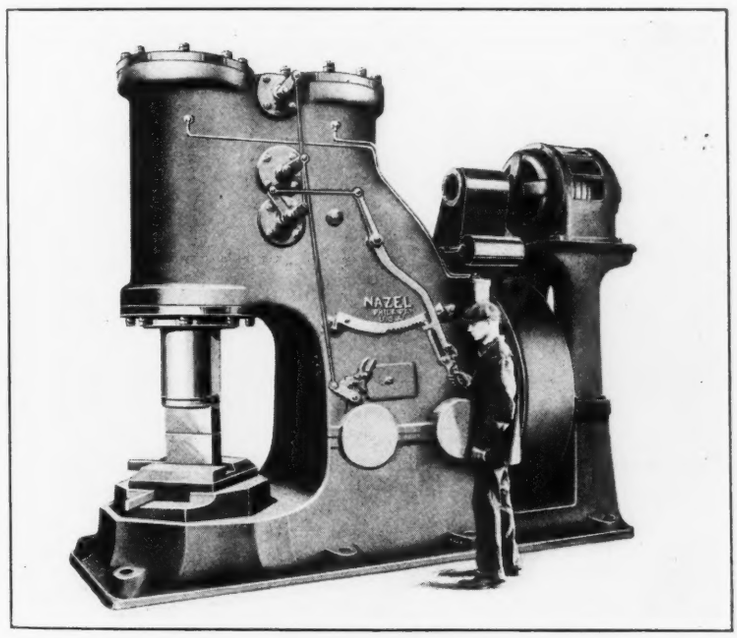
NAZEL HEAVY-DUTY HAMMER

Mild steel up to 10 inches square can be worked by a No. 7 Type B heavy-duty hammer recently added to the line of self-contained motor-driven air hammers built by the Nazel Engineering & Machine Works, Philadelphia, Pa. The ram of this machine has a 32-inch stroke, and the distance from the center of the ram to the housing is 30 inches. The machine is driven by a 60-horsepower constant-speed motor, requires a floor space of 168 by 68 inches, and weighs about 58,300 pounds.

The ram is a hollow-bored forging of the plugless type and

slides in a long guide to insure rigidity. The baseplate is cast in one piece and is secured to the cylinder frame or housing by means of four rings shrunk on machined bosses which form part of the housing and base.

The anvil block, which is made of a special gray iron, is separate from the hammer base, resting independently on the foundation and weighing 21,000 pounds. The diagonal forging position renders the dies accessible from all sides and enables long bars to be worked in either direction across the anvil, clear of the hammer frame. Other features of the machine include a noiseless exhaust, an automatic force-feed lubrication system, and a belted motor drive.



Nazel Motor-driven Air Hammer which Works Mild Steel up to 10 Inches Square

"WELDITE" ROD FOR CARBON ARC WELDING

A welding rod for carbon arc welding having a flux coating designed to cause the arc to pull from the hottest part of the weld puddle is a recently announced development of the Fusion Welding Corporation, 103rd St. and Torrence Ave., Chicago, Ill. This product is known as "Weldite C-No. 6 Fluxed" rod. It is particularly adapted for welding mild steel plates and castings, being suited for foundry work and rail joint welding. The advantages claimed for this rod are high welding speeds, strength, ductility, and the production of easily machined welds. The rod may be laid in place on the work or held in the hand as the welding proceeds.

TAYLOR-WINFIELD SPOT AND PROJECTION WELDING MACHINE

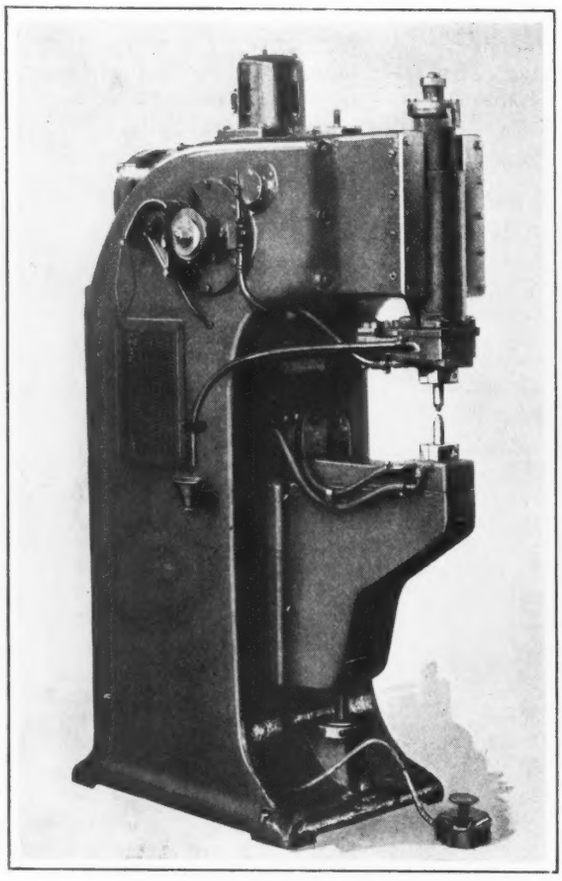
Four operating speeds are available on the "Challenger" intermediate-sized spot and projection welding machine now being introduced on the market by the Taylor-Winfield Corporation, 509 Mahoning Ave., N.W., Warren, Ohio. These speeds are made available through the use of a four-speed constant-torque motor and its four-speed control. The motor control is located in the base of the machine and is operated by a conveniently located handwheel. Extra gears may be had for the motor shaft and driving shaft to give different speeds, as required by welding conditions.

Two pieces of 3/8-inch stock can be welded on this machine when it is equipped with the 18-inch throat by using the slow speed and the large size transformer. On projection welding, five projections can be welded within an area of 7 square inches on 1/8-inch stock or lighter material. The transformer capacity is from 40 to 80 kilovolt-amperes on a 50- or 60-cycle current, or 30 to 60 kilovolt-amperes on a 25- to 30-cycle current. The transformer is of the "pancake" type and is water-cooled throughout.

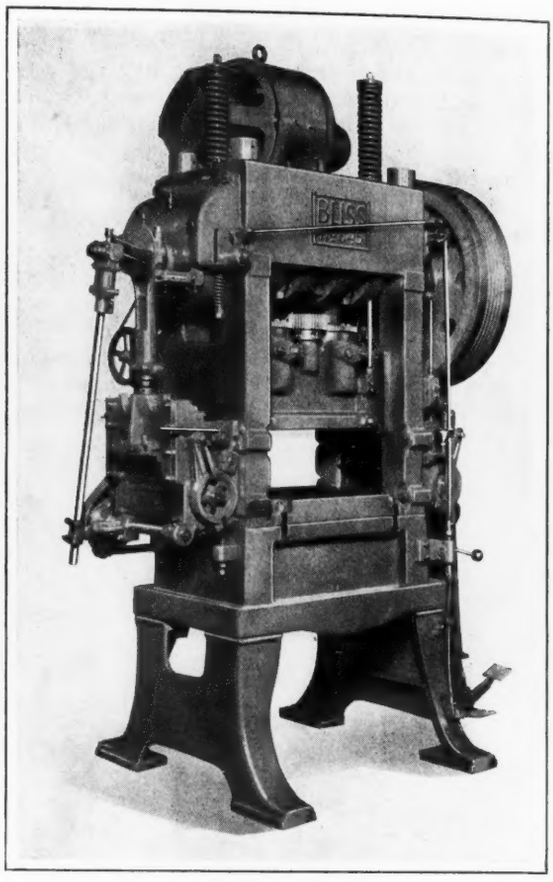
The operating head is actuated by a cam through a toggle action. The slides are 15 inches long and are provided with gibs for maintaining alignment and obtaining adjustment. There is a visible water-flow connection in full view of the operator at all times. The lower arm has a vertical adjustment of 6 1/2 inches, and the upper head a stroke of 1 3/4 inches.

An eight-step selector switch is provided which can be instantly shifted to any position. The magnetic clutch control, which is positive and instantaneous in its action and so designed that it will not repeat unless tripped, is shown at the top of the machine. The remote control switch is actuated by a graduated cam which can be easily adjusted to increase or decrease the heat as required. Different throat depths are made available by using different slide castings which are bolted to the main casting. The standard throat depths are 12, 18, and 24 inches. By using special "overhang" arms, it is possible to obtain a throat depth of 30 inches for welding light-gage stock.

In the illustration, the remote control switch is shown with the guard removed. A special water control switch is provided, which allows water to flow only at the moment of welding, thus conserving the water supply and eliminating condensation on the transformer coils while the machine is standing idle. The flexible cable trip switch can be placed in any convenient position on the floor. The clutch and



"Challenger" Spot and Projection Welding Machine Made by the Taylor-Winfield Corporation



Bliss High-production Press Equipped with Improved Shear Type Scrap Cutter

transmission of the machine are operated magnetically and run in oil. The machine occupies a floor space of 25 by 45 inches and has a height of 74 1/2 inches. Its weight is 3100 pounds.

SHEAR TYPE SCRAP CUTTER FOR BLISS PRESSES

Simplicity of construction and fewer moving parts, resulting in lower maintenance cost and more silent operation, are advantages claimed for the shear type scrap cutter recently brought out by the E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn, N. Y., for use on all the high-production presses made by this concern. The shear slide is driven from an eccentric on the extended crankshaft of the press instead of by a separate shaft located at right angles to the main shaft, as in the case of the cutter illustrated on page 336 of December, 1929, MACHINERY. The eccentric drive is so arranged that the scrap cutter is timed 30 degrees behind the press slide, giving the pilots ample time to locate the strip before it is locked by the shear blades. There is no necessity, therefore, for making "hair-line" adjustments to synchronize the press slide and the scrap shear properly.

Regular press-type gibs are used on the shear slide and take-up screws are provided, so that a tight sliding fit can be maintained. The upper shear blade is mounted in an adjustable holder which functions in a manner similar to that of the table of a squaring shear. This adjustment makes it possible to obtain a fine clearance between the blades, which is essential in cutting thin stock. This is perhaps the most important improvement, from an operating standpoint, incorporated in the new shear.

A plate, backed up by springs, holds the stock down tight against the lower blade to insure efficient cutting. The shear blades are made of Neor steel when used for cutting hard silicon steel, such as is required for radio, motor, and power transformer laminations.

BARNES DRILL CO.'S HONING MACHINE FOR MEDIUM-SIZED CYLINDERS

Cylinders up to 20 inches in diameter and not over 30 inches in length can be honed in the No. 2420 medium heavy-duty vertical honing machine recently developed by the Barnes Drill Co., 814 Chestnut St., Rockford, Ill. This machine is all-geared,

self-oiling, and fully equipped with radial ball bearings and Timken roller bearings. Bearings of the latter type are furnished for the spindle. The machine is intended for finishing Diesel-engine sleeves and cylinders; various types of cylinders for locomotive service; hydraulic, air-compressor, air-brake, oil- and gas-engine, and pump cylinders, etc. In the illustration, the machine is shown equipped with a ball-bearing rolling fixture for honing Diesel-engine cylinder liners.

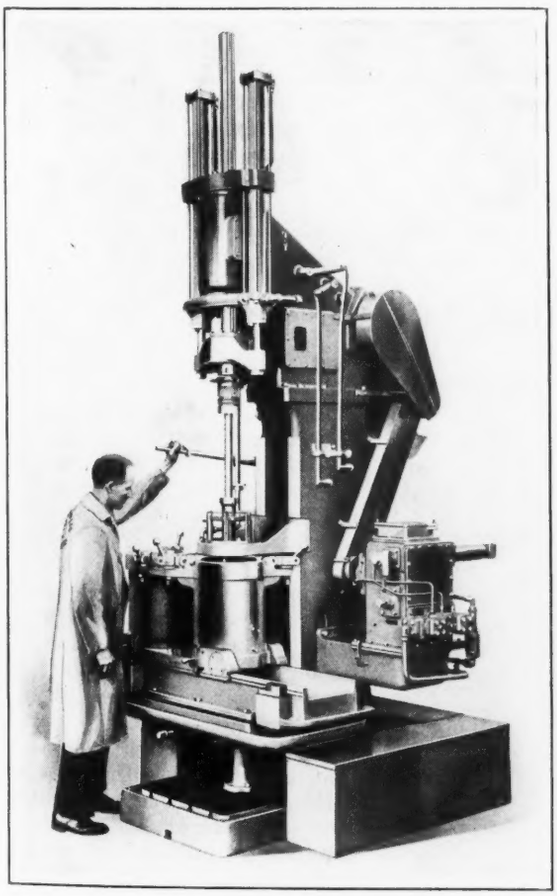
The reciprocating and rotating spindle of the new machine is hydraulically controlled as to length and rapidity of stroke, the same as the larger honing machine described in February MACHINERY, page 478. The length of stroke may be set to give just the desired amount of over-run of the hone at each end of the cylinder, which is important in preventing bell mouths, barrel shapes, and tapers.

Parallel hydraulic cylinders are used on opposite sides of the spindle housing to minimize the height and allow for various lengths of stroke. The piston-rods are directly connected to the lower end of the spindle. A yoke connection provides for attaching multiple heads when desired. The spindle and hone assembly are balanced by a patented air counterbalance.

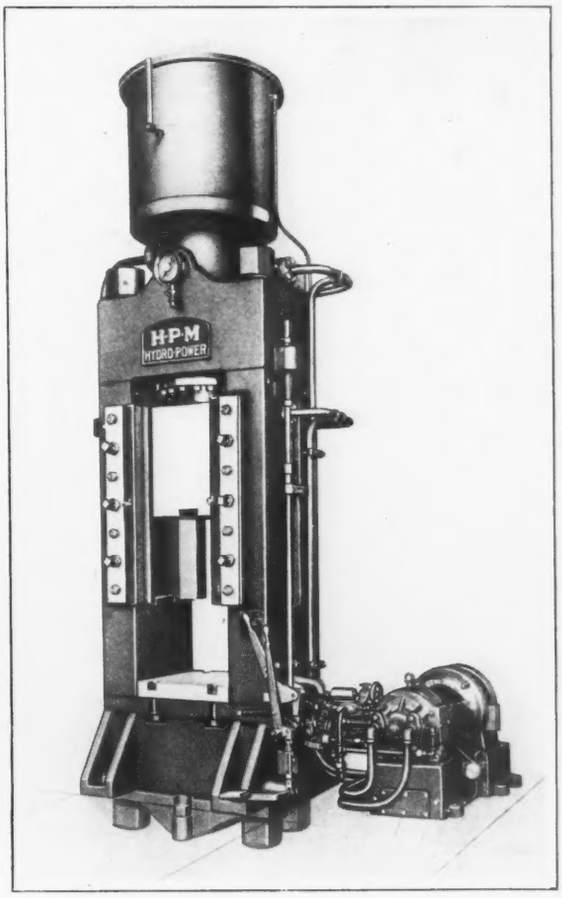
Four quick-change spindle speeds are available, and back-gears may be furnished to give four additional slower speeds, in which case the total range of speeds is from 32 to 354 revolutions per minute. The machine is operated through a lever which controls both the multiple-disk driving clutch and the spindle reciprocations. The cycles of reciprocation may be changed to suit the job by means of valves on the Oilgear pump used. Equipped with the Oilgear hydraulic pump, motor, starter, and filter, the machine weighs approximately 6000 pounds.

H-P-M "HYPRO-POWER" PRESSES

High-speed automatic operation through the use of special hydraulic control mechanisms is one of the principal features of a line of "Hypro-Power" presses being introduced to the trade by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. It is claimed that these machines combine the production speed of mechanically operated presses with the smoothness and flexibility of hydraulic presses. The machines are built in a range of sizes of from 150 to 2000 tons pressure. There are two standard types, an open-side type which is built with bolsters ranging from 60 by 36 inches up to 216 by 72 inches, and the square-bed type illus-



Hydraulically Controlled Honing Machine Built by the Barnes Drill Co.



H-P-M "Hypro-Power" Press which has a High-speed Automatic Action

trated, which is built with bolsters from 24 by 24 inches up to 60 by 60 inches.

Among the various advantages claimed for these presses is a variable working stroke, the length of stroke being adjustable to suit the work. Another advantage is that the dies can be changed from one press to another and easily set up. The total pressure applied to the work is indicated by a direct-reading gage. Full pressure can be developed at any point along the stroke, and the pressure is automatically regulated to meet requirements. The press cannot be overloaded while in operation, even though extra stock is accidentally inserted. This feature insures against damage to the dies. Adequate protection of the operator is also afforded by the control. Hammer blow shocks are avoided due to the method of applying pressure. The presses are entirely self-contained.

These presses may be operated either automatically or semi-automatically. In the semi-automatic cycle, the operator trips a lever or pedal to start the platen downward at a fast closing speed. When the platen closes on the work, its speed is automatically reduced to the full load rate. As soon as the pressure is built up to a predetermined limit, the motion of the press is automatically reversed and it opens at the fast speed, the platen returning to an adjustable upward position where it stops. The full automatic cycle is the same, except that after the press has once been started, it repeats the cycle until again stopped by the operator. Oil is used as a pressure medium.

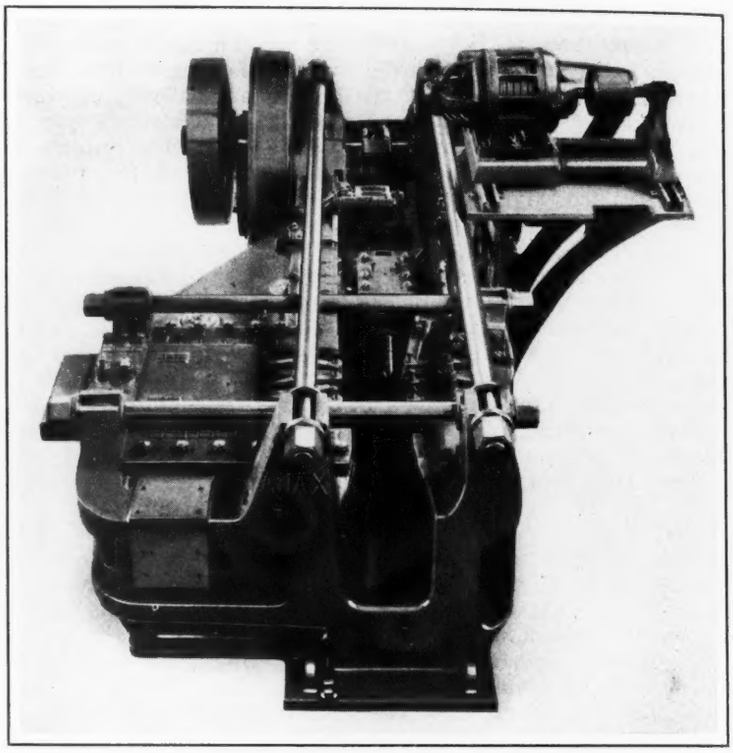


Fig. 1. Front View of Ajax "Super" Upsetter

These presses are suitable for metal-working operations such as blanking, coining, drawing, embossing, forming, offsetting, punching, piercing, stamping, and straightening. Both shallow stampings and deep drawn parts can be produced, owing to the fact that the variable working stroke can be adjusted to suit the requirements of each job.

AJAX "SUPER" UPSETTER

What is believed to be the largest upsetting forging machine in the world has been developed and built by the Ajax Mfg. Co., Cleveland, Ohio, for the Spang, Chalfant & Co., Inc., Pittsburgh, Pa. This machine weighs 410,000 pounds, and is driven by a 100-horsepower motor.

When the machine is in operation, the twin flywheel drive and the heavy crankshaft are kept in constant rotation by the motor which drives the machine through twin gearing. Although the heavy header slide alone weighs 14 tons, the machine is said to operate with no more noticeable shock or vibration than that resulting from the stamping of a foot. Front and rear views of the machine are shown in Figs. 1 and 2, respectively.

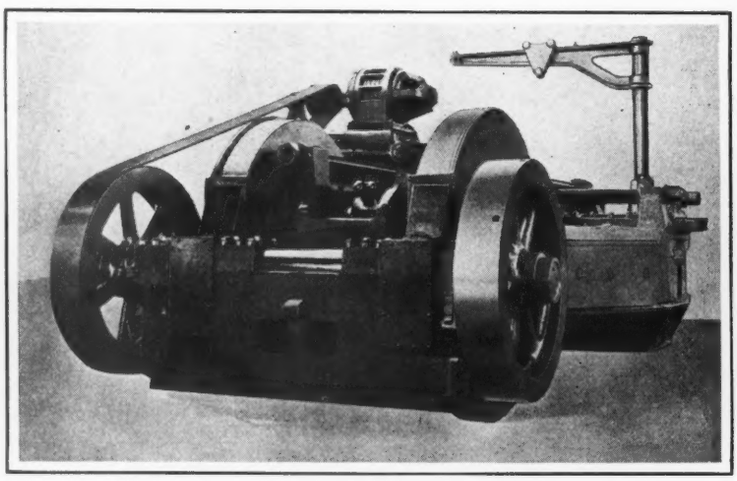
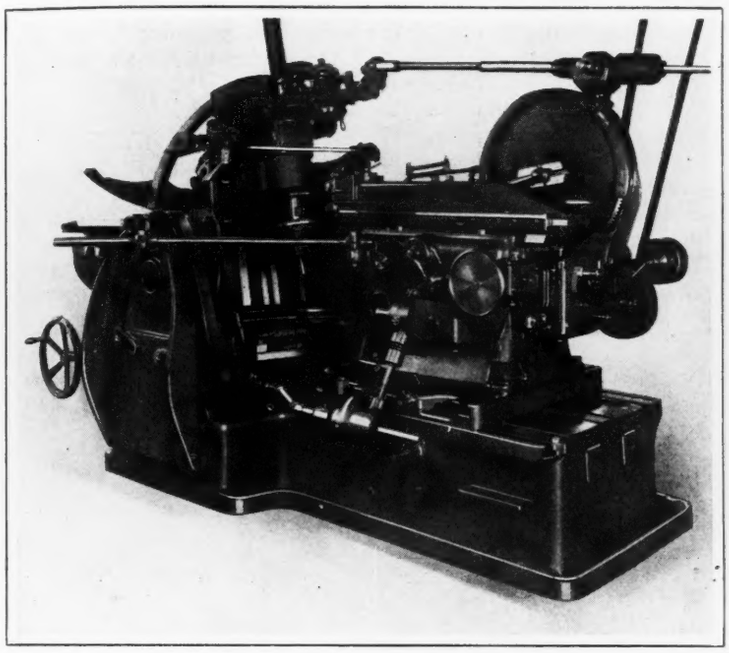


Fig. 2. Rear View of Upsetter, Showing Twin Flywheels



Reinecker No. 3 Bevel Gear Generator

REINECKER BEVEL GEAR GENERATORS

Six different sizes of bevel gear generating machines, with capacities for cutting straight and spiral tooth bevel gears ranging in size from 7/16 to 43 inches in diameter, have been brought out by J. E. Reinecker A. G., Chemnitz-Gablenz, Germany.

These machines are being placed on the American market by the George Scherr Co., 142 Liberty St., New York City. They are of the self-generating principle type and are designed to index the gear blank from tooth to tooth after each cutting stroke, so that the heat generated, as well as any effect of wear on the tooth, is evenly distributed over the entire circumference of the work.

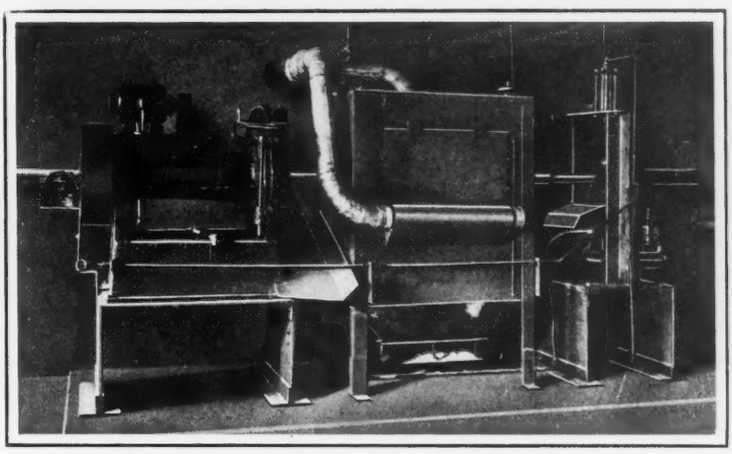
These machines have been developed to meet the needs of machinery builders who require precision bevel gears that will operate noiselessly at high speeds. A quick-change gear-box and a single-pulley drive are features of the machines. The larger sized machines are provided with adjustable ram saddles for accommodating pinions cut integral with the shaft. The approximate weight of the No. 0 or smallest size machine, which is made for cutting straight teeth only, is 1650 pounds. The largest or No. 4 machine weighs 24,650 pounds.

RYERSON-NEW HAVEN FLUE CLEANER

In order to ascertain the actual condition of boiler flues, it is necessary to remove the scale from the surface of the flues and the pitted holes. If the scale is not thoroughly removed from the pits, it may conceal corroded areas sufficient to render the flue unsuited for further service. To meet the needs of railroad shops for a cleaner that will effectively remove this scale from locomotive boiler flues, Joseph T. Ryerson & Son, Inc., Chicago, Ill., has developed the Ryerson - New Haven sand-blast flue cleaner which is shown in the accompanying illustration.

This cleaner consists of five units—the scale cracking unit, the sand-blast cabinet, the flue puller, the dust arrester, and the exhauster. Any standard or superheater size flue from 1 1/2 to 6 inches outside diameter can be handled with this equipment. The time required to clean a 2-inch flue is one minute, and the rate for 6-inch superheater flues is 20 per hour.

In the scale cracking unit, the tube passes between rolls having teeth that bear against the outside and thus crack up the scale. These rolls do not mark or damage the flues, and are mounted at an angle so that they feed the flues on into the sand-blast cabinet where sand from a battery of nozzles is forced at high velocity against the flue while it revolves. The sand drops back to the bottom of the cabinet from where it is sucked up through rubber tubes and used over again. All dust is removed from the sand through the dust manifold and is caught in cloth bags. When the advancing end of the flue has passed through the sand-blast cabinet, the flue puller continues the revolving and feed-



Ryerson-New Haven Sand-blast Flue Cleaner

ing motion until the flue has passed entirely through the machine.

TERKELSEN PRESSES FOR MOLDING COMPOSITIONS

For molding synthetic compositions, the Terkelsen Machine Co., Terkelsen Building, 326 A St., Boston, Mass., has brought out two electrically operated presses known as the Type A-1 Model 50 and the Type E-1 Model 50 shown in Figs. 1 and 2, respectively. The 50-ton press of the model shown in Fig. 1 has platens 12 by 16 inches. The 50-ton press of the model shown in Fig. 2 has platens 12 by 18 inches, and in the 100-ton size, platens of 18 by 24 inches and 24 by 24 inches. It is possible to make variations in these sizes to suit the requirements of the work to be handled.

The presses are fitted with automatic ejectors, so that the operator merely has to remove the pieces and refill the die. If desired, however, they can be manually operated without delay in making the change-over.

The molding pressure can be regulated manually from 1 to 50 tons on the 50-ton size. The stroke can be adjusted quickly for any length within the range of the machine. The machine can be set to stop automatically at the end of the stroke or when any desired pressure has been obtained. At the end of the curing period, the molds open automatically. Indicators which can be easily read show the pressure developed. During the follow-up or curing process, the required pressure is exerted by the spring-loaded accumulator.

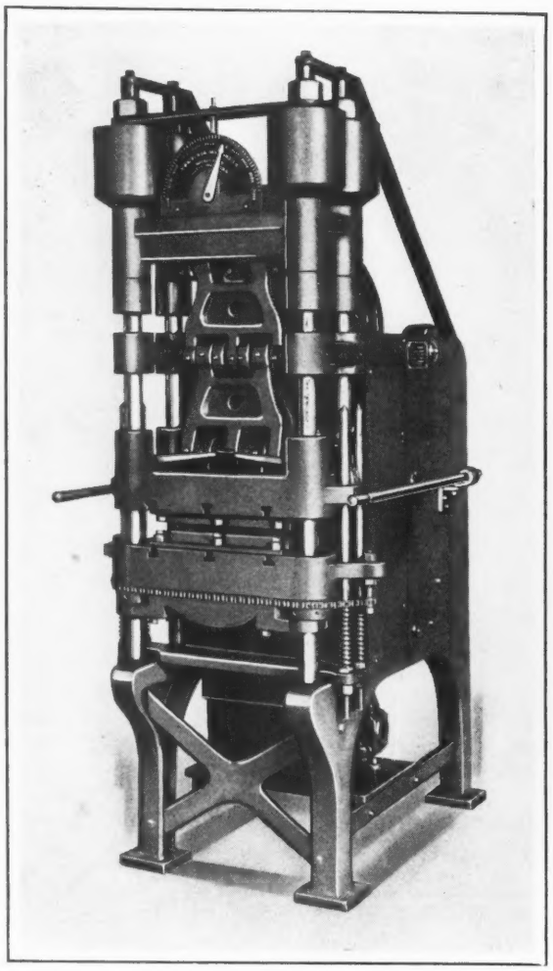


Fig. 1. Terkelsen "Electro Draulic" Press for Molding Compositions

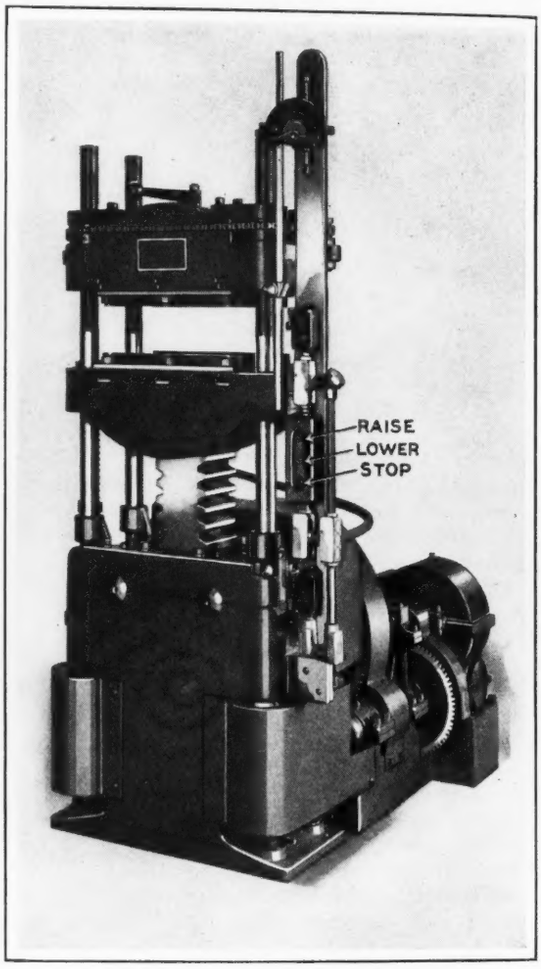
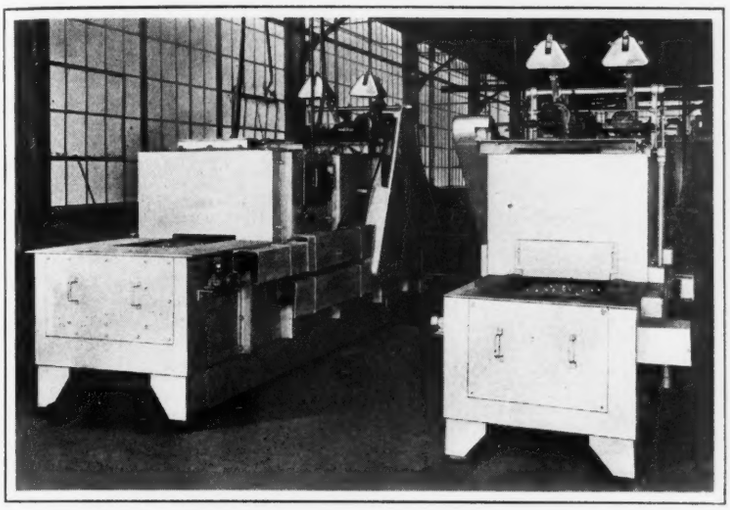


Fig. 2. Another Type of Terkelsen Electrically Operated Molding Press

CONVEYOR TYPE HEAT-TREATING FURNACE

A conveyor furnace, known as the "Floating Belt" type, for heat-treating small parts on a quantity production basis, has been developed by the Hevi Duty Electric Co., Milwaukee, Wis. The notable feature of this furnace is the method of driving the conveyor through the furnace chamber. The conveyor consists of a woven mesh belt composed of heat-resisting nickel-chromium alloy wire of 3/16 inch mesh.

The conveyor belt is supported on driven rollers which are close-



Heat-treating Furnace Equipped with Wire-mesh Conveyor

ly spaced throughout the length of the furnace chamber in order to impart a smooth even drive. As no hearth plate is employed in the furnace, the bottom heating elements radiate heat directly through the conveyor to the work. This construction results in a relatively small heating chamber for a given production rate.

A furnace having a hearth area 1 1/2 feet by 12 feet heats 1000 pounds of small parts an hour at a temperature of 1550 degrees F. Loading densities as high as 30 pounds per square foot have been found practical. The heating elements are located on the side walls, beneath the conveyor, in the arch, and at all available places at the discharge end of the furnace. This type of furnace is now available in five standard sizes, having production rates ranging from 250 to 1400 pounds per hour.

CINCINNATI GRINDING ATTACHMENT FOR MILLING CUTTERS

For sharpening face milling cutters from 8 to 18 inches in diameter, the Cincinnati Milling Machine Co., Cincinnati, Ohio, has built a grinding attachment applicable to the Cincinnati No. 2 plain or universal cutter grinders that were recently placed on the market. The attachment consists of three units—the spindle assembly, the swivel base, and the special arbor, as shown in the illustration. The work-holding spindle has a No. 7 Morse taper socket, and is mounted in anti-friction bearings.

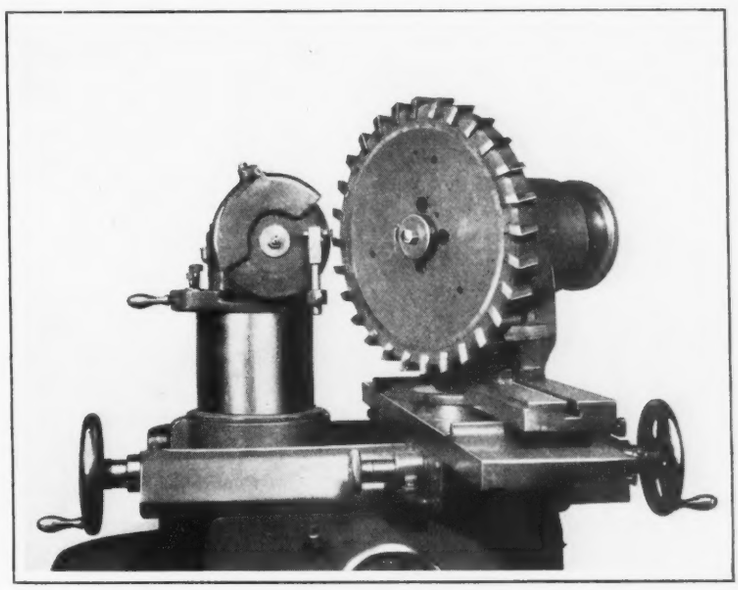
The knurled handwheel at the rear of the spindle provides a convenient means of swinging the cutter into the grinding position. The swivel base is graduated in degrees from 0 to 360. Provision is made for locking the spindle after the cutter blade has been set in line with the center line of the grinding wheel spindle, in order to prevent any movement of the cutters while setting up the tool-rest.

The distance from the center of the cutter-holding spindle to the table is 9 1/2 inches. The equipment consists of a No. 7 Morse taper arbor for holding face mills that fit spindles having the National Standard spindle end; a special pulley for the driving motor; a straight grinding wheel 8 inches in diameter with a face 3/8 inch wide; and a wheel guard. The weight of the attachment is 135 pounds.

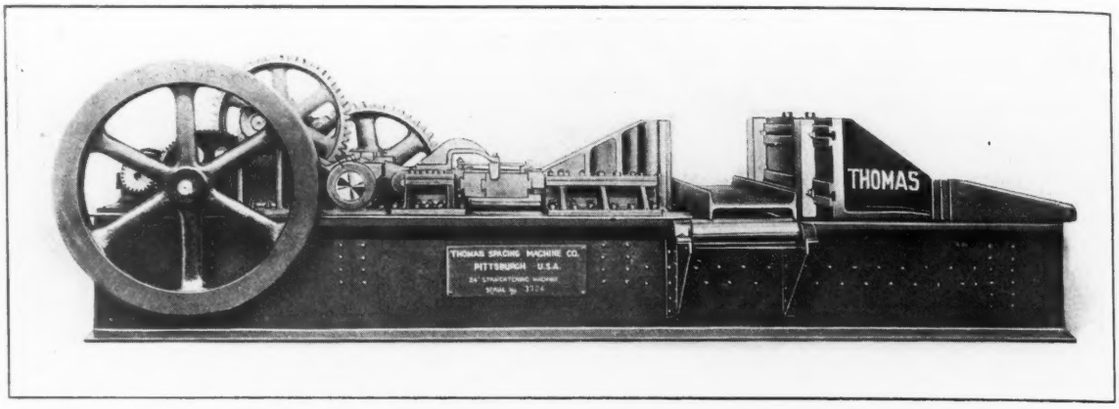
THOMAS BENDING AND STRAIGHTENING MACHINE

A bending and straightening machine designed to accommodate all structural shapes has recently been brought out by the Thomas Spacing Machine Co., 811 Fulton Bldg., Pittsburgh, Pa. This machine is built in 150- and 300-ton sizes. As illustrated, the frame is built up of structural steel, all parts that take thrusts being both riveted and welded. The design is such that the rivets alone will carry the load with a large factor of safety when the machine is operated at its maximum capacity. Strength and lightness are advantages claimed for this construction.

The machine is intended for universal application to bending



Cincinnati Grinding Attachment for Face Milling Cutters



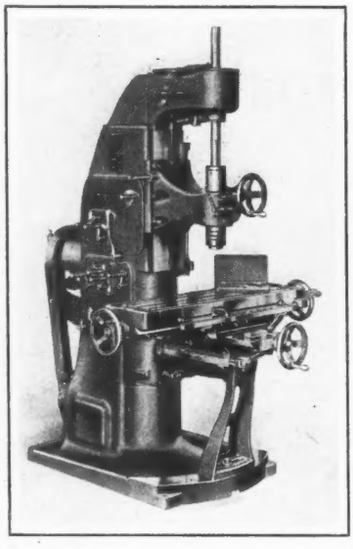
Thomas Bending and Straightening Machine for Structural Shapes

and straightening work. Warped pieces can be straightened and restored to their original shapes with but little effort, while by making a slight adjustment of the wedges, it is possible to produce almost any desired bend on any class of material within the capacity of the machine.

IMPROVED KNIGHT VERTICAL MILLERS

A number of improvements, including an increase in capacity, have been made in the No. 4 and No. 3-B vertical millers manufactured by the W. B. Knight Machinery Co., 3920 Pine St., St. Louis, Mo. The throat capacity or distance from the face of the column to the center of the spindle and also the width of the table and the amount of cross-feed have been increased approximately 20 per cent.

The improved method of mounting the dial indicators on these machines, as shown in the illustration, adapts them for use in jig boring and similar work. The tilting table is equipped with dial indicators, giving it the effect of a universal fixture.



Knight Vertical Miller of Improved Design

HERCULES PNEUMATIC DRILL AND GRINDER

The Hercules No. 34-3 pneumatic drill assembled on a portable and adjustable drill stand, as shown in Fig. 1, and the No. 362-4 Hercules sander and cup-wheel grinder shown in Fig. 2 have recently been placed on the market by the Buckeye Portable Tool Co., Dayton, Ohio. The portable pneumatic drill shown in Fig. 1 has been designed especially for use on large dies and castings. It has a capacity for drilling holes up to 1 1/4 inches in steel. The spindle has a feed of 7 inches, and is equipped with a No. 3 Morse taper socket. An anchoring chain is provided to facilitate drilling operations.

The maximum elevation of the tool is 45 degrees above the horizontal. The stand may be raised or lowered, the maximum height being 44 1/2 inches, and the minimum height 32 3/4 inches. Lubrication of the air motor rotor is adjusted by a needle valve connected with a reservoir in the base. This reservoir has a capacity of one-half gallon, which is sufficient for two weeks' operation. The oil passes through the hose to the rotor. A foot-operated air throttle controls the motor, so that the hands are left free for feeding or directing the drill.

The portable air-operated grinder shown in Fig. 2 is designed for use with felt pads, abrasive disks, or cup-wheels. This grinder is equipped with a governor which gives a higher speed under load, thus conserving the air supply. As in other Hercules tools equipped with governors, the air does not pass through the governor, but is delivered directly to the rotor. Both handles of the grinder are placed near the center of the tool to facilitate the application of maximum grinding pressure without overbalancing the tool. The grinder is equipped with the

Fig. 1. Hercules Portable Pneumatic Drill

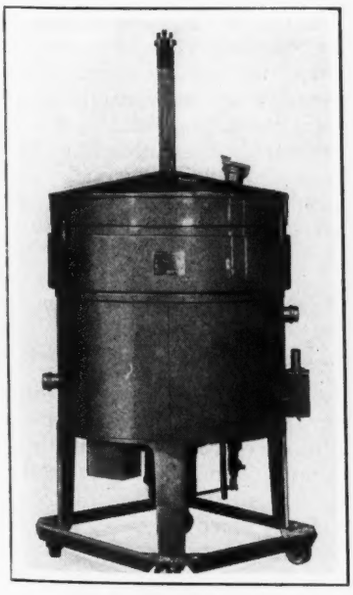
Fig. 2. Pneumatic Sander and Cup-wheel Grinder

Hercules safety throttle, and an oil reservoir is provided in the dead air handle.

"HOMO" NITRIDING FURNACE

For surface hardening steel tools or machine parts on a production basis by the nitriding process, the Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa., has brought out the "Homo" nitriding furnace shown in the illustration, and equipment for its automatic control. With this furnace, the parts to be nitrided are put in a container which is lowered into the furnace. Electric heating coils surround the work chamber, but are separated from it by a cylindrical radiation shield. Around the chamber is a passage through which compressed air is blown at the end of a run for cooling the furnace quickly. The top of the furnace is made gas-tight by means of an oil seal.

After the furnace is loaded and the nitriding operation started, the ammonia gas enters by means of a port in the lid. The fan at the bottom of the furnace drives the air through passages that take it first past the heating coils and then into the work. A feature of the furnace is a reversible fan, which reverses its direction of rotation every minute. This action is provided to insure more uniform treatment of the work. The work space in the smaller of the two sizes of furnaces now being made is 14 inches in diameter by 16 inches deep; in the larger furnace, it is 21 1/2 inches in diameter by 26 inches deep.

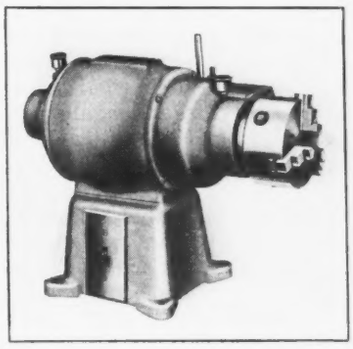


"Homo" Nitriding Furnace Developed by Leeds & Northrup Co.

SCHAUER "IDEAL" SPEED LATHE

For finishing and polishing small parts in production plants, the Schauer Machine Co., 905 Broadway, Cincinnati, Ohio, has brought out the "Ideal" speed lathe shown in the illustration. The 1/2-horsepower, two-speed, totally enclosed, dustproof motor of this lathe is equipped with ball bearings and an automatic brake. It is designed to operate continuously without overheating at speeds of 2700 and 1350 revolutions per minute on direct current and at speeds of 3400 and 1750 revolutions per minute on alternating current.

Either the high or low speed can be selected by means of a switch in the motor base. The motor is started by a slight backward movement of the hand-lever. A forward movement of the lever shuts off the current and automatically applies the brake to an extended surface of the motor spindle. The brake-shoe is lined with a material designed for long service, and means are provided for adjusting the pressure exerted on the rotating member.

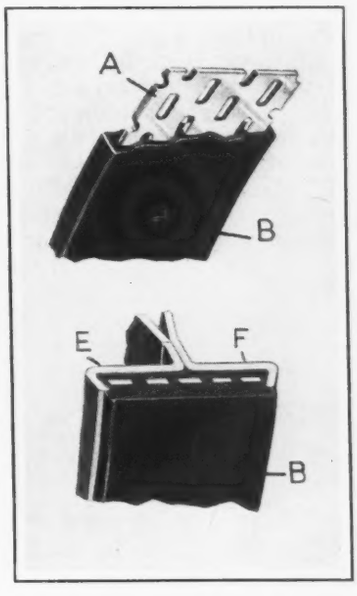


"Ideal" Speed Lathe

The hollow spindle within the motor permits the insertion of rods or tubular stock up to 1 inch in diameter to a distance of 9 inches from the face of the chuck, thus making it possible to polish rods up to 12 or 16 inches in length without using an end support. The lathe is regularly equipped with a three-jaw universal chuck having a capacity for holding rods up to 1 inch in diameter and for chucking work up to 4 inches in diameter. This lathe is available in either bench or pedestal type.

CARTER BAND SAW WHEEL

A rigid wheel with a patented quick-change tire for use on any standard type of band saw has



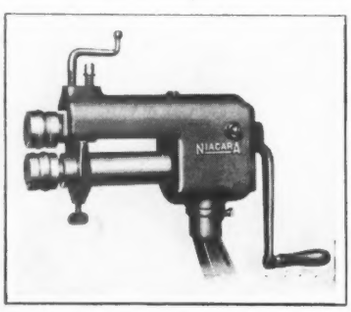
Construction of Carter Band Saw Tire

recently been placed on the market by the Carter Products Co., 409 Home State Bank Bldg., Grand Rapids, Mich. This wheel is designed for either high- or low-speed band saws employed in the metal and woodworking industries. The flexible tire *B* has an endless perforated steel core, as shown at *A* in the broken sectional view of the accompanying illustration. This core is molded into the tough rubber tire, giving a cushioning and self-centering construction which is designed to eliminate vibration.

The tire is mounted on a wheel made up of two die-stamped disks of electric-welded construction. Any make of wheel hub required to suit the machines to be equipped is built into the wheel. The lower view of the illustration shows how the tire *A* is gripped by the flanges *E* and *F* of the wheel rim. By simply removing the nuts from bolts spaced around the rim, the flange *E* can be removed so that the tire can be quickly replaced.

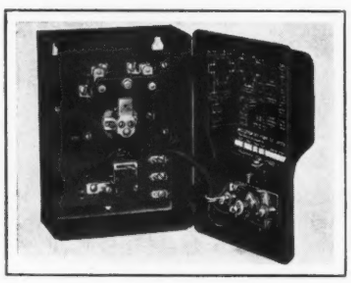
NIAGARA BEADING MACHINE

The No. 193 direct-drive beading machine recently placed on the market by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y., has a capacity for performing beading operations on sheet metal up to 22 gage. The depth of the throat from the center of the rolls to the frame is 8 1/4 inches, in which respect it differs from the combination bench machine described in November, 1927, MACHINERY, page 236. The one-piece enclosed frame is designed to give adequate strength and provide safety for the operator.



Niagara Beading Machine with Deep Throat

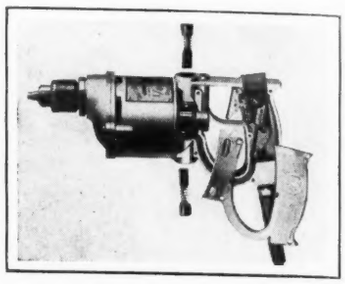
The upper shaft is raised and lowered by means of a quick-acting crank screw. Provision has been made for easily lubricating the large accurately fitted bearings. The steel gears are machine-cut and completely enclosed. The faces of the case-hardened steel rolls are kept flush with the ends of the shafts by countersunk nuts. A gage with a large gaging surface is provided, which can be clamped in any desired position by means of a thumb-screw. The regular equipment includes one pair of 3/4-inch O.G. beading rolls, a bench standard, and a wrench. Straight and spiral crimping rolls, and beading rolls of various sizes, which are interchangeable with the beading rolls regularly furnished, can be supplied if desired.



Allen-Bradley Starting Switch for Single-phase Motors

ALLEN-BRADLEY STARTING SWITCH

A starting switch for single-phase motors employed for operating compressors, pumps, oil burners, refrigerators and other motor-driven devices governed by either two-wire or three-wire control has recently been brought out by the Allen-Bradley Co., 499 Clinton St., Milwaukee, Wis. This starter is of the double-pole magnetic type with a thermal overload relay. A feature of the switch is the operating coil which has a double winding for series parallel connections that enables it to be used on either 110- or 220-volt motors up to and including 1 1/2 horsepower by simply changing the terminal connections. Push-buttons for starting and stopping the motor can be located in the cover or a two-way lever switch can be provided.



Portable Electric Drill with Bohnalite Housing

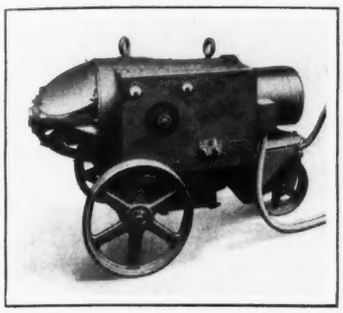
PORTABLE ELECTRIC DRILLS WITH BOHNALITE HOUSINGS

The 1/4-, 5/16-, and 3/8-inch portable electric drills and the Nos. 1 and 2 sizes of screwdrivers, valve grinders and tappers made by the United States Electrical Tool Co., 2477 W. Sixth St., Cincinnati, Ohio, are now being made with Bohnalite metal housings. It is claimed that the strength of these tools has been greatly increased by this construction, and that they will stand up longer under rough handling and hard service.

The special 1/4-, 5/16-, and 3/8-inch drills are designed to permit the removal of one side of the handle and housing end in one piece. This construction makes the switch, wiring, and commutator more easily accessible when servicing becomes necessary. The lines of the handle of these drills have also been changed to give a better grip and improve the appearance of the tool.

WESTINGHOUSE "FLEX-ARC" WELDERS

Arc stability and flexibility over the entire current range, both at extreme low and high current values are distinctive features of the new "Flex-arc" welders recently developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These features are obtained by the use of a special piece of ap-



Westinghouse 200-ampere "Flex-arc" Welder with "Flexactor" Mounted under the Frame

paratus known as a "Flexactor," which replaces the reactor formerly used and differs in principle of operation from other types now employed.

With this equipment, the striking and maintaining of an arc under all operating conditions is greatly facilitated and the explosive arc characteristics are eliminated. Other features of the welders are the drip-proof and compact construction, mobility, wing-nut terminals for the welding cable connections, and single rheostat adjustment with calibrated dials for adjusting the welding current accurately.

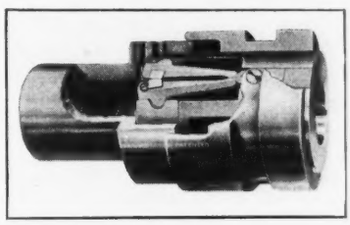
SOUTH BEND METRIC SYSTEM LATHES

A line of metric system precision lathes suitable for cutting a wide range of International and French metric standard threads, from 0.5 to 8 millimeter pitch, is being placed on the market by the South Bend Lathe Works, 772 E. Madison St., South Bend, Ind. These machines correspond to the regular line of 9- to 18-inch back-geared screw-cutting engine lathes made by this company.

The precision lead-screws, gears, and spindle noses of these machines are made according to the metric system. The cross-feed and compound-rest screws are furnished with micrometer collars graduated for regulating the depth of cut by hundredths of a millimeter. These machines resemble the regular line in appearance except for the gear-box and headstock gear guard. The movement of the quick-change gear lever, however, is opposite that of the lever employed on the regular line of lathes. Like the regular lathes, the metric system machines are recommended for use in making precision master taps, thread gages, dies, and fixtures, as well as for regular toolroom, manufacturing plant, engineering laboratory, and repair shop work.

JOHNSON FRICTION CLUTCH

Chrome-nickel steel fingers, an improved method of locking the adjusting screw, chrome-nickel steel adjusting blocks, and the Alemite system of lubrication are some of the features incorporated in the "Super-clutch" brought out recently by the Carlyle Johnson Machine Co., Manchester, Conn. Chrome-nickel steel is employed for the fingers to increase the wearing qualities



Johnson Friction Clutch

and reduce breakage to a minimum. With the new locking arrangement, the adjustment of the clutch is permanent and cannot be changed by vibration or operation at high speeds.

SMALL SIZE NITRIDING FURNACE

To meet the demand for a small nitriding furnace suitable for experimental and limited production work, the Hevi Duty Electric Co., 4100 Highland Ave., Milwaukee, Wis., has developed a small electric furnace of the forced circulation type known as the Type MU-500-N. The design follows closely that of the larger production furnaces of this company's manufacture in that it consists essentially of a pit furnace enclosing an alloy retort which is bolted and sealed to the furnace cover. A centrifugal fan for producing rapid circulation of the gases in the furnace is also supported by the cover.

The work to be nitrided is placed in an alloy basket 8 inches in diameter by 20 inches deep. This basket, in turn, is placed in the retort which is bolted and sealed to the furnace cover. The retort is next "gased" to exhaust all the air. It is then placed in the furnace, which has already been brought up to the required temperature.

Upon completing the nitriding cycle, the retort is removed from the furnace and the flow of ammonia continued through the work while it is cooling. Another charged retort immediately replaces the one removed from the furnace. The furnace has an electrical input of 3.5 kilowatts at 220 or 110 volts, and is equipped with an automatic temperature control.

MARQUETTE METAL DRAWING AND RIVETING EQUIPMENT

A cushioned press bed, a die spotting machine, and a riveting machine are being placed on the market by the Marquette Tool & Mfg. Co., 1904 N. Kilbourne Ave., Chicago, Ill. The cushioned power press bed, shown in Fig. 1, is built with the air cushion blank-holder of this company's manufacture. This bed is said to embody all the features of a standard press bed in combination with the blank-holding qualities furnished by the pneumatic cushion. When this bed is used, no pit or special foundation is required. No auxiliary air tank is necessary, as the bed is constructed to give the required air displacement. The beds can be furnished for any size or make of press.

The die spotting machine

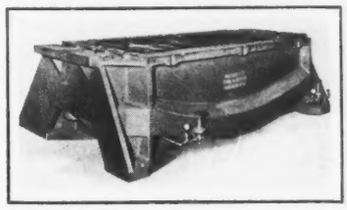


Fig. 1. Marquette Cushioned Press Bed

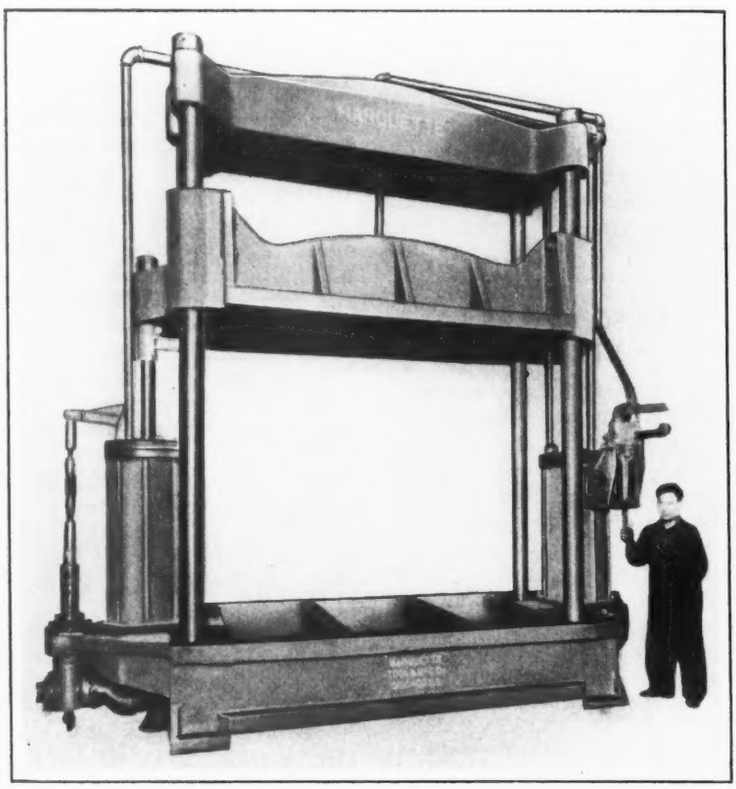


Fig. 2. Marquette Die Spotting Machine

shown in Fig. 2 is designed to exert full spotting pressure when fitting the dies, so that only a slight amount of dressing is required to put them in shape for operation. The movement of the slide or ram is actuated by compressed air from the regular air supply of the shop. The bed and ram are held in alignment by four guide rods. The ram can be operated at any desired speed. This machine is made in various sizes ranging from the small bench machine to the 100-ton size.

The riveting machine shown in Fig. 3 is equipped with a hydro-pneumatic die cushion which automatically compensates for variations in thickness of the parts riveted, providing the necessary pressure to fully expand and head the rivets under all ordinary operating conditions. When desired, special means for cutting out the cushioning action of the press can be incorporated in the machine, so that it can be employed for punching, forming, or other work of this kind.

RUTHMAN TWO-STAGE PUMP

A two-stage pump known as the Model A-L has recently been added to the line of vertical motor-driven pumps made by the Ruthman Machinery Co., 532 E. Front St., Cincinnati, Ohio. This pump develops a pressure of 39 pounds per square inch, which enables it to pump liquids to a height of over 90 feet. The driving motor is of 1 1/2 horsepower and has a speed of 1725 revolutions per minute. The pump is adapted for such work as supplying coolant to a number of machine tools from a central reservoir, creating pressure for hydraulically operated machine tools and for air cleaning and humidifying systems.

Like all gusher pumps of this company's manufacture, the one illustrated has no packing and is of ball bearing construction. The intake is made with a stationary device consisting of three curved blades which prevent the water from whirling and assuming a conical shape. The object of this feature is to prevent the entrance of air and thus provide a flow of liquid free from air bubbles.

* * *

A two-reel motion picture illustrating the manufacture of Monel metal has been made by the Rothacker Film Corporation, Chicago, Ill. The picture shows the preparation of this metal in its various commercial forms at the Huntington, W. Va., plant of the International Nickel Co. The film can be obtained without charge from the International Nickel Co., Inc., New York City.

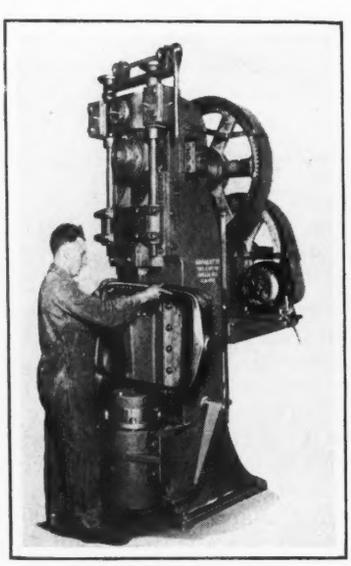
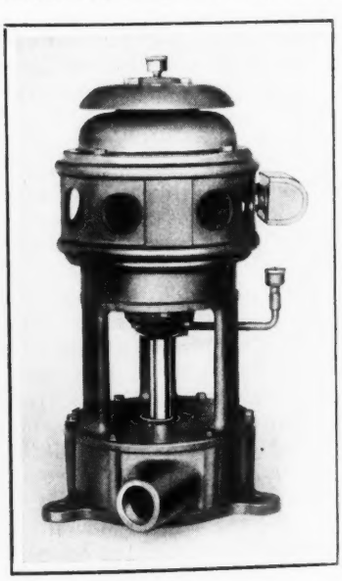


Fig. 3. Marquette Riveting Machine

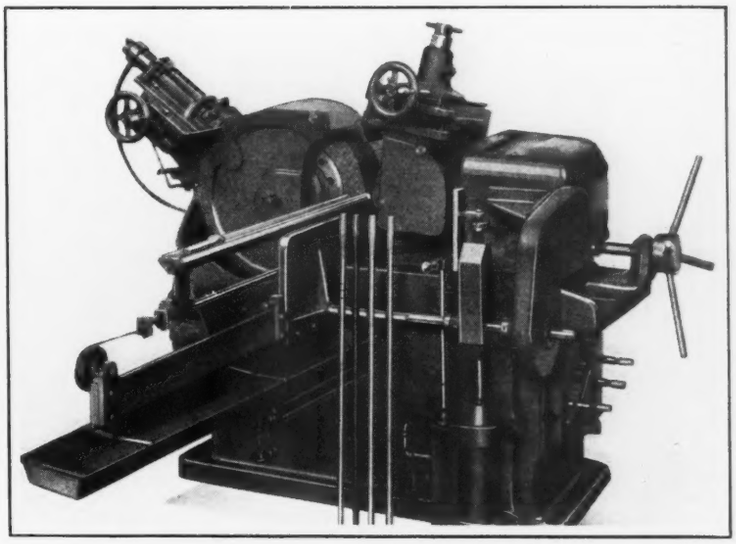


Ruthman Two-stage Motor-driven Pump

GRINDING GOLF CLUB SHAFTS IN A CENTERLESS GRINDER

One of the most recent innovations in the field of centerless grinding is the development of a fixture and method for grinding tapered golf club shafts. This new development by the Cincinnati Grinders Incorporated, Cincinnati, Ohio, opens up a new field of application for the centerless grinding process.

The golf shafts are placed in the work guide of the fixture with the grip end nearest to the wheels, and are passed between the formed grinding and regulating wheels by a pusher action. By manually depressing a lever at the front of the fixture, a piston automatically descends in a vertical hydraulic cylinder. This piston actuates a splined shaft which, in turn, transmits motion to two trains of gears which are synchronized—one set being connected to the pusher movement for the work and the other set to the feed-screw nut of the regulating slide. Thus a definite in-feed movement for the grinding wheels relative to the forward travel of the work between the wheels is provided, giving a predetermined taper to the shaft. The relationship between the work travel and the in-feed slide can be varied for different tapers, shapes, and lengths through change-gears.

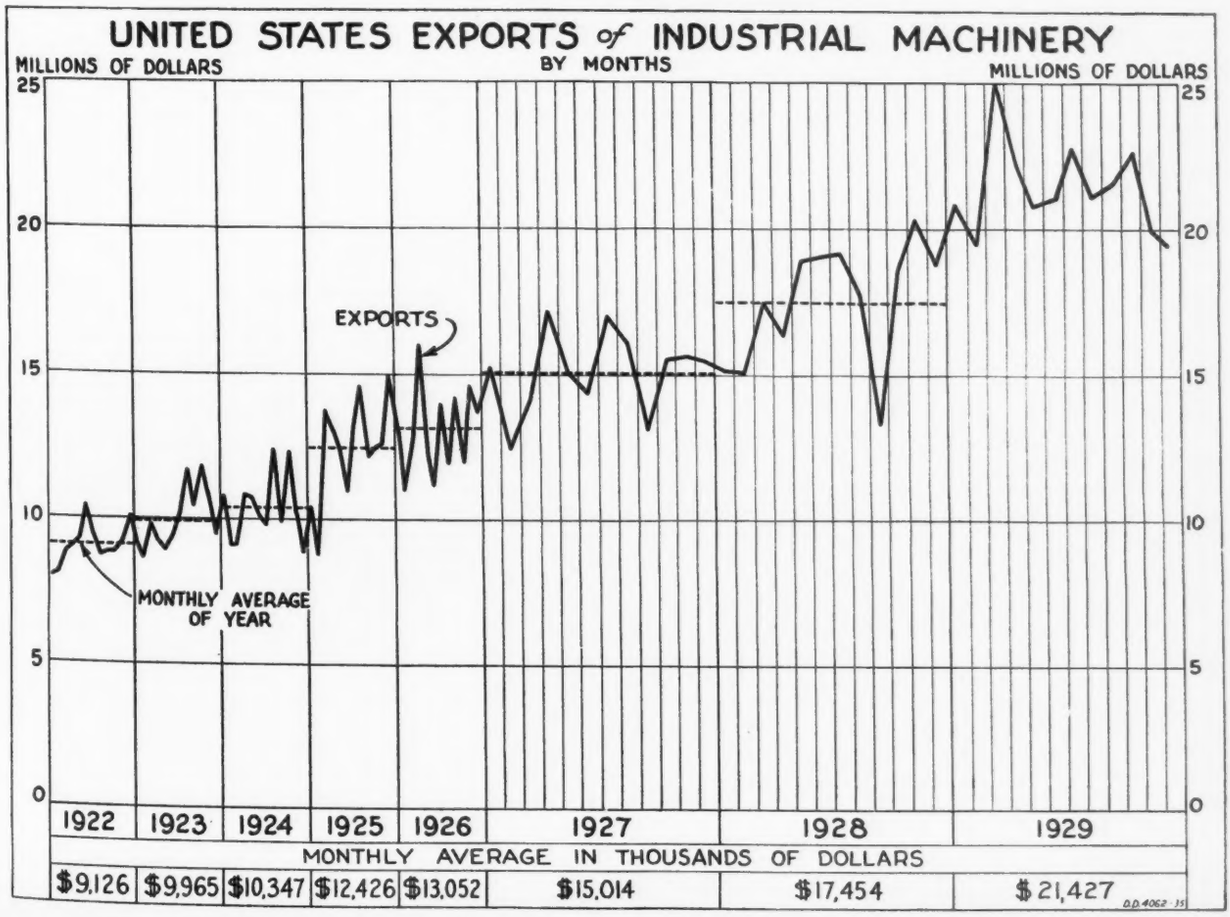


Tapers are Ground in this Centerless Grinder by Synchronizing the Wheel Feed and the Work Travel

Automatic forward travel and return makes it possible to load and unload the work at the front of the machine. A net production of 300 finished ground taper shafts per hour is obtained with this arrangement. Other classes of work for which this machine and fixture are specially adapted include tapered steel shafts and rods of various lengths, rods with intermittent tapers, tapers in reverse directions, etc. When grinding wooden shafts, paraffin oil is used to prevent the wheel from becoming loaded. Other materials require the use of a regular coolant.

* * *

The total imports of industrial machinery into New Zealand in 1928, the last year for which complete statistics are available, were approximately $4,000,000, according to *Commerce Reports*. Machine tools to a value of $480,000 were imported, the value of the imports from the United States being about $90,000 and from the United Kingdom, $300,000.



PERSONALS

"TED" HILL has been appointed sales manager of the Detroit Gray Iron Foundry Co., Detroit, Mich.

H. N. MATHIAS and V. F. COVERT have been elected assistant general auditors of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

FRANK B. HAMERLY has been elected vice-president in charge of manufacturing of the Independent Pneumatic Tool Co., 606 W. Jackson Blvd., Chicago, Ill.

W. A. MARSCHKE has been appointed Indiana representative of the sanders, grinders, and saws made by the Porter-Cable Machine Co., Salina and Wolf Sts., Syracuse, N. Y.

L. FORD MERRITT has been appointed manager of the Detroit office of the Union Chain & Mfg. Co., Sandusky, Ohio, manufacturer of elevating, conveying, and power transmission machinery.

H. W. BOYD has been made vice-president and secretary of the Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia, Pa. Mr. Boyd serves as superintendent of the Olsen plant.

RALPH W. WHEELER has been appointed sales manager of the Automatic Devices Division of Robbins & Myers Sales, Inc., Springfield, Ohio. Mr. Wheeler takes the place of William D. Root, who recently resigned.

ROBERT A. HORNER has been appointed acting sales manager of the Machine and Small Tool Divisions of Barber-Colman Co., Rockford, Ill., to succeed Frank G. Hoffman, sales manager, who died suddenly in February.

C. BRIGHAM ALLEN, JR. has been appointed district sales representative of the Philadelphia office of the Reliance Electric & Engineering Co., Cleveland, Ohio, manufacturer of alternating- and direct-current motors.

EARL F. REINHART, for the last fifteen years associated with the Pullman Car & Mfg. Co., Chicago, Ill., has joined the combined Latrobe Tool Co. and J. M. Carpenter Tap & Die Co. in the capacity of assistant to president.

F. E. HARRELL has been appointed engineer in charge of the drafting and experimental departments of the Reliance Electric & Engineering Co., Cleveland, Ohio, manufacturer of alternating- and direct-current motors.

H. HOBART PORTER has been re-elected chairman of the Engineering Foundation, 29 W. 39th St., New York City. OTIS E. HOVEY and G. N. CLEVENGER were elected vice-chairmen of the Foundation, and ALFRED D. FLINN was re-elected director and secretary.

H. H. GILDNER has joined the Tinius Olsen Testing Machine Co. as assistant to the president, Thorsten Y. Olsen. Mr. Gildner was previously chief engineer of the S K F Industries, Inc., and more recently was manager of the industrial division of the Timken Roller Bearing Co.

FRANK J. VOGEL, formerly in charge of the standards department of the R. D. Nuttall Works of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has become associated with The Thomas Spacing Machine Co., Pittsburgh, Pa., manufacturer of fabricating machinery, in the capacity of chief inspector.

M. C. STEFFEN has been made manager of the Cincinnati office of Cutler-Hammer, Inc., Milwaukee, Wis., manufacturer of electric control apparatus, to take the place of R. I. MAUJER, who has resigned. Mr. Steffen has been at the St. Louis office of the company for the last five years.

J. R. FARRELL has been transferred from the St. Louis office of the Gardner-Denver Co., Denver, Colo., to the Tulsa office as rock drill representative. E. H. DIAMONDS, formerly of the Andrews & George Co., is now associated with the San Francisco office of the Gardner-Denver Co. as rock drill representative.

DR. H. E. FOOTE has received an appointment to fill the Industrial Fellowship on Oxygen Research at the Mellon Institute of Industrial Research, Pittsburgh, Pa. This Fellowship has been established by the Gas Industries Co., Inc., Pittsburgh, Pa., designer and builder of liquid air oxygen apparatus.

W. R. ANGELL was elected president of the Continental Motors Corporation, Detroit, Mich., at a recent meeting of the Board of Directors. Mr. Angell has been with the company for many years, having served as secretary, vice-president, and chairman of the finance committee. He succeeds R. W. JUDSON, who has been made chairman of the Board.

P. LOYD LEWIS, formerly manager of the Kansas City branch office of the Wagner Electric Corporation, has been transferred to the home sales office at 6400 Plymouth Ave., St. Louis, Mo., where he will have charge of the merchandising division. Mr. Lewis has been connected with the Kansas City office since 1913 and has been manager since 1918.

GEORGE V. MYRMIRIAN has recently come to this country from France to visit a number of American manufacturers of machine tools and shop equipment with a view to obtaining their sales representation in France. While in this country, Mr. Myrmirian can be reached in care of the Errington Mechanical Laboratory, 200 Broadway, New York City.

E. R. NORRIS, formerly general works manager, has been appointed assistant to the vice-president in charge of manufacturing of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. In his new position, he will be responsible for all plant facilities of the company, manufacturing methods, cost reduction, and inspection. Mr. Norris has been connected with the company since 1892.

W. C. MINIER and F. C. LORENZ have been added to the Cleveland sales and engineering staff of the Reading Chain & Block Corporation, Reading, Pa. Mr. Minier was formerly associated with the Shepard Crane & Hoist Co., and Mr. Lorenz was connected for many years with the Cleveland Electric Tramrail Co. The Cleveland offices of the company are located in the Rockefeller Building.

FRANK W. CURTIS, until recently connected with P. R. Mallory & Co., Inc., Indianapolis, Ind., as chief engineer in charge of Carboloy manufacture and developments, has become research engineer with the Kearney & Trecker Corporation, Milwaukee, Wis., manufacturer of knee type Milwaukee milling machines and production type Mil-Waukee-Mils. His duties will comprise the compilation of milling data through tests based on the standpoint of economical machine operation.

R. D. EVANS and C. F. WAGNER of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., have been awarded the George Montefiore Prize for the year 1929. This prize is presented for the best original work contributing to scientific advancement in the technical applications of electricity. The papers for which Messrs. Evans and Wagner were awarded prizes were entitled "Studies of Transmission Stability," and "Static Stability Limits and the Intermediate Condenser Station."

FRANK J. BURD has been made manager of the Philadelphia office of Cutler-Hammer, Inc., 1204 St. Paul Ave., Milwaukee, Wis., manufacturer of electrical control apparatus, to take the place of T. E. BEDDOE, who has resigned. Mr. Burd had been connected with Cutler-Hammer, Inc., continuously for the last thirty years, with the exception of two years during the war period. He was formerly stationed at Chicago, where he has been in charge of the steel mill division for the last nine and one-half years.

WILLIAM H. EAGER was re-elected president of Whitman & Barnes, Inc., Detroit, Mich., and its subsidiary, the Canadian Detroit Twist Drill Co., Ltd., at a recent stockholders' meeting. Other officers of Whitman & Barnes, Inc., elected at the meeting were KARL KENDIG, vice-president and treasurer; J. I. HOLTON, secretary; and N. J. SMITH, assistant secretary. Other officers of the Canadian Detroit Twist Drill Co., Ltd., are E. L. FOREMAN, vice-president; KARL KENDIG, secretary and treasurer; and R. G. MATLEY, general manager.

DR. JAMES ASTON, director of mining and metallurgy at the Carnegie Institute of Technology, and consulting metallurgist of the A. M. Byers Co., Pittsburgh, Pa., has had the Robert W. Hunt Medal conferred upon him by the American Institute of Mining and Metallurgical Engineers. The medal was conferred upon Dr. Aston because of his work in connection with a new development in wrought iron manufacture, the new method being commercially known as "Byers' New Wrought Iron Process." This process was described in March MACHINERY, page 580.

HAROLD WHITEHEAD, who has been one of the executives of the Business Training Corporation, 350 Madison Ave., New York City, recently sailed for London to establish a similar business service of

his own. By means of a reciprocal arrangement with his former firm, both concerns will be able to render sales and merchandise service to firms in the export and import field. For ten years, Mr. Whitehead was the head of the department of sales relations and business methods in the College of Business Administration, Boston University.

PROFESSOR COLLINS P. BLISS, associate dean of the College of Engineering of New York University, has been made dean. Professor Bliss graduated from Princeton University in 1888 and from the Columbia School of Architecture in 1891. He also received a Master's degree from Princeton. He has been a member of the American Society of Mechanical Engineers since 1903. From 1924 to 1929 he served on the Society's Standardization Committee, the last two years as chairman. He is at present serving as chairman of the Sectional Committee on pipe flanges.

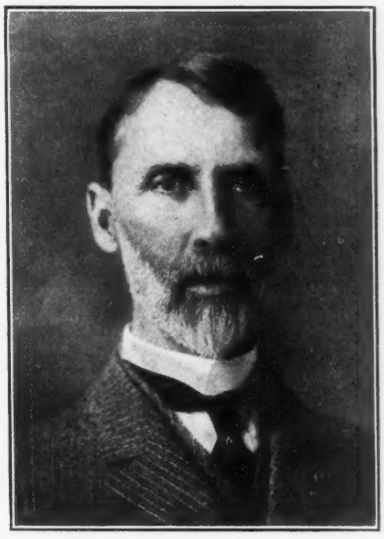
CYRIL AINSWORTH, formerly director of the Bureau of Industrial Standards of the Pennsylvania Department of Labor and Industry, has been placed in charge of the National Safety Code work of the American Standards Association, 29 W. 39th St., New York City. Mr. Ainsworth will direct the work of the association in establishing national codes for the guidance of state and municipal governments, industrial organizations, and insurance companies. JOHN WILSON MCNAIR, formerly of the Standards Department of the American Institute of Electrical Engineers, and CLARENCE EDWARD DARLING, formerly of the staff of the American Society of Mechanical Engineers, have also joined the staff of the American Standards Association. Mr. McNair will devote his efforts to electrical standardization projects, and Mr. Darling will handle mechanical and chemical projects.

CLAYTON R. BURT, since 1924 general manager of the Pratt & Whitney Co., Hartford, Conn., and since 1925 also vice-president of the company, has been made president and will also continue as general manager. Mr. Burt is a director of the Pratt & Whitney Co., as well as of the Niles-Bement-Pond Co. W. P. KIRK, who has been with the Pratt & Whitney Co. since he graduated from Columbia University in 1907, and who has been general sales manager since 1927, has been elected a director and made vice-president in charge of sales. E. L. MORGAN, who has been connected with the Pratt & Whitney and affiliated companies since 1897 and who has been chief accountant of the Pratt & Whitney Co. since 1925, has been elected secretary and assistant treasurer. DAVID AYR, who in 1925 became factory manager and in 1928 manager of the machinery division of the company, has been elected a member of the Board of Directors. CHARLES M. POND, who has been in the employ of the company since 1903 and who since 1923 has been manager of the small tool division, has also been elected a director.

OBITUARIES

JACOB D. COX

Jacob Dolson Cox, chairman of the Board of the Cleveland Twist Drill Co., Cleveland, Ohio, died February 23 at his winter home in Pasadena, Calif., aged seventy-seven years. Mr. Cox was born in Warren, Ohio, and after attending school there went to Cleveland in 1868 and entered the employ of the Cleveland Iron Co. He spent about seven years at this plant, and in 1875 formed a partnership with C. C. Newton at Dunkirk, N. Y., for the manufacture of milling machines; later in the same year this business was moved to Cleveland and conducted under the name of Newton & Cox. The rapid growth in the metal trades about this time pointed to an increase in the use of small tools,



Jacob D. Cox

and, as there were none manufactured west of the Alleghenies at that time, Newton & Cox also directed their efforts toward the production of twist drills and reamers.

In the spring of 1880, changing industrial conditions indicated that the products required separate plants, so in the spring of that year Mr. Newton withdrew and started the production of machine tools in Philadelphia. Mr. Cox continued the manufacture of small tools, and in the fall of 1880 formed a partnership with F. F. Prentiss. At first the business was conducted as Cox & Prentiss, but in 1904 it was incorporated under the name of the Cleveland Twist Drill Co. Until the time of his death, Mr. Cox was actively interested in the management of the company, this being the fiftieth year of his association with Mr. Prentiss.

He was keenly interested in engineering subjects, and had been a frequent contributor to trade magazines. As an industrialist he was quick to sense changing trends of manufacturing methods and employe welfare, and in 1915 instituted a bonus system that is still in successful operation. He is survived by his widow, Mrs. Ellen Prentiss Cox, a daughter, Mrs. Gordon Morrill, and two sons, S. H. Cox and J. D. Cox, Jr., the latter president and general manager of the Cleveland Twist Drill Co.

PERRIN GEORGE MARCH, founder and president of the Cincinnati Shaper Co., Cincinnati, Ohio, died on February 26, aged seventy-seven years. Mr. March had not taken any active part in the business for three years. In all, he had been identified with the machine tool industry for a period of forty years. He had been a member of the Board of Directors of the Ohio Mechanics' Institute for a number of years, and was president at the time that the present building of the Institute was erected.

BERNARD J. HAUSFELD, who was connected for thirty-two years with the Lunkenheimer Co., Cincinnati, Ohio, most of the time in the capacity of advertising manager, died suddenly on February 18 at the age of fifty-two years.

NEWS OF THE INDUSTRY

ELECTRIC MACHINERY MFG. CO., Minneapolis, Minn., announces that its Detroit office is now located at 10-230 General Motors Building, Detroit, Mich.

DUMORE CO., manufacturer of motors and portable electric grinders, has removed its office to the Park-Murray Building, 9-15 Park Place, New York City.

FAFNIR BEARING CO., New Britain, Conn., has appointed the Rose-Hoskins Supply Co. distributor for Fafnir transmission equipment in the Houston, Texas, territory.

OHIO ELECTRIC & CONTROLLER CO., 5900 Maurice Ave., Cleveland, Ohio, announces that the firm name was changed at the last annual meeting of the shareholders to the OHIO ELECTRIC MFG. CO.

PORTER-CABLE MACHINE CO., Salina and Wolf Sts., Syracuse, N. Y., has appointed the Triplex Machine Tool Co. of New York City, agent for Porter-Cable manufacturing lathes in New York and vicinity.

GEARS & FORGINGS, INC., has moved the Ganschow Division of the company to 2108-2120 N. Natchez Ave., Chicago, Ill. The new location provides approximately 30,000 square feet of manufacturing space.

FEDERAL PRESS CO., Elkhart, Ind., has recently appointed the Motch & Merryweather Machinery Co., Cleveland, Ohio, exclusive representative of the company in the Cleveland, Cincinnati, and Pittsburgh territories.

BAKER BROTHERS, INC., Toledo, Ohio, has appointed W. L. MacRae, 728 State Tower Building, Syracuse, N. Y., representative of the company for the western part of New York, including Syracuse, Rochester, and Buffalo.

Brown &

"Cost Less

Productive Cutters Pile Up Chips

DEEP cuts—fast speeds—it takes good cutters to pile up chips steadily and to keep production at the highest level. Cutters which will stand up for long periods of time under heavy loads are a distinct asset to you.

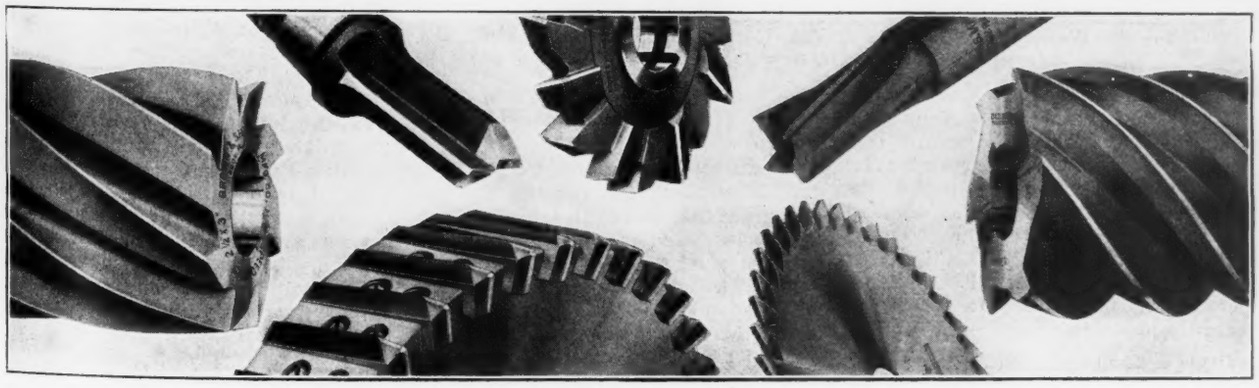
Brown & Sharpe Cutters stand up well on all types of work with few interruptions for sharpening (sharpening cutters means loss of productive man and machine time). By reducing these maintenance costs, Brown & Sharpe Cutters give you lowest "real cutter cost." They will prove an economical investment for you.

Our No. 31 Catalog lists the complete line. Copy sent on request. Brown & Sharpe Mfg. Co. Providence, R. I.

B·S

The Cost of
Time Lost Removing Cutters
Plus Time Lost Replacing Cutters
Plus Lost Production
Plus Sharpening Cutters
Plus Original Purchase
Equals
Real Cost of Cutters

What is the Real Cost of Your Cutters?



Sharpe Cutters

When You Figure Real Cost"

CLEVELAND PLANER CO., 3148 Superior Ave., Cleveland, Ohio, has appointed Knickerbocker, Cram & Co., Inc., 7 E. 42nd St., New York City, representative for the sale of Cleveland open-side planers in the New York territory.

BRIGGS MFG. CO., Detroit, Mich., announces its entry into the general stamping field. This department of the company will be under the supervision of S. J. Menzel, formerly manager of sales of the Mullins Mfg. Corp'n, Salem, Ohio.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa., was presented with the Harvard Award for the "general or institutional advertising campaign conspicuous for the excellence of its planning and execution." The award, consisting of a certificate and a cash prize of $2000, was received on behalf of the company by J. C. McQuiston, general advertising manager of the Westinghouse organization, and A. L. Billingsly, president of Fuller & Smith, Cleveland, Ohio, advertising agency, for the Westinghouse products.

A. L. Billingsley, President of Fuller & Smith, Advertising Agency, and J. C. McQuiston, General Advertising Manager of the Westinghouse Electric & Mfg. Co., Who have Received the Harvard Award for the Westinghouse Electric & Mfg. Co.'s National Institutional Advertising Campaign in Newspapers in 1929

BLISS & LAUGHLIN, INC., Harvey, Ill., manufacturers of cold-drawn steel and shafting, at a recent meeting of the Board of Directors elected Walter R. Howell president and general manager, and W. P. Mitchell vice-president. Howard H. Hersey was re-elected treasurer.

BAKER BROS., INC., Toledo, Ohio, have appointed W. L. Cameron, Newark, N. J., direct agent for the company in the New Jersey territory that is not handled by the Philadelphia dealer. The Stedfast & Roulston Co., Boston, Mass., has been appointed agent in the New England territory.

NATIONAL ACME CO., Cleveland, Ohio, announces that the Charles A. Strelinger Co., 149 E. Larned St., Detroit, Mich., is now handling the sales and service of "Namco" opening threading dies, collapsing taps, other production threading tools using "Namco" chasers, and "Namco" chaser grinding fixtures.

SIVYER STEEL CASTING CO., Milwaukee, Wis., recently consolidated with the NUGENT STEEL CASTINGS CO., of Chicago, Ill. At a stockholders' meeting the following officers were elected: C. R. Messinger, chairman of the board; L. S. Peregoy, president; M. A. Fladoes, vice-president in charge of sales; George L. Pollock, secretary; and C. A. McDonald, treasurer.

UNITED STATES ELECTRICAL TOOL CO., 2477 West Sixth St., Cincinnati, Ohio, announces that an additional roller bearing is now being included in the chuck spindles of the ⅝- and ¾-inch heavy-duty drills manufactured by the company, the object being to provide for the double thrust in cylinder reconditioning work and to insure easier operation and longer drill life.

DESMOND-STEPHAN MFG. CO., Urbana, Ohio, manufacturer of grinding-wheel dressers, has purchased the Rearwin emery-wheel dresser and cutter business from the QUADRIGA MFG. CO., of Chicago, Ill. These dressers and cutters will now be manufactured under the name of "Desmond-Rearwin," and will be added to the complete line of wheel-truing tools made by the Desmond-Stephan Mfg. Co.

W. F. & JOHN BARNES CO., Rockford, Ill., which was established in 1872, announces the formation of a new division known as the JOHN S. BARNES CORPORATION. This concern will produce a new line of automatic machinery. John S. Barnes, son of the original John Barnes, is president; C. H. Rystrom, vice-president in charge of sales; E. J. Svenson, vice-president in charge of engineering; and W. W. Barton, secretary and treasurer.

GEOMETRIC TOOL CO., New Haven, Conn., has opened an office in Detroit in the Stormfeltz-Loveley Building, Woodward Ave. and Grand Boulevard, where a stock of standard tools and chasers will be carried. This office has been opened in order to give better and quicker service to the firm's customers in Detroit and the state of Michigan. Charles A. Strelinger Co., who have been representing the company in Detroit, will continue to sell Geometric threading machines and chaser grinders.

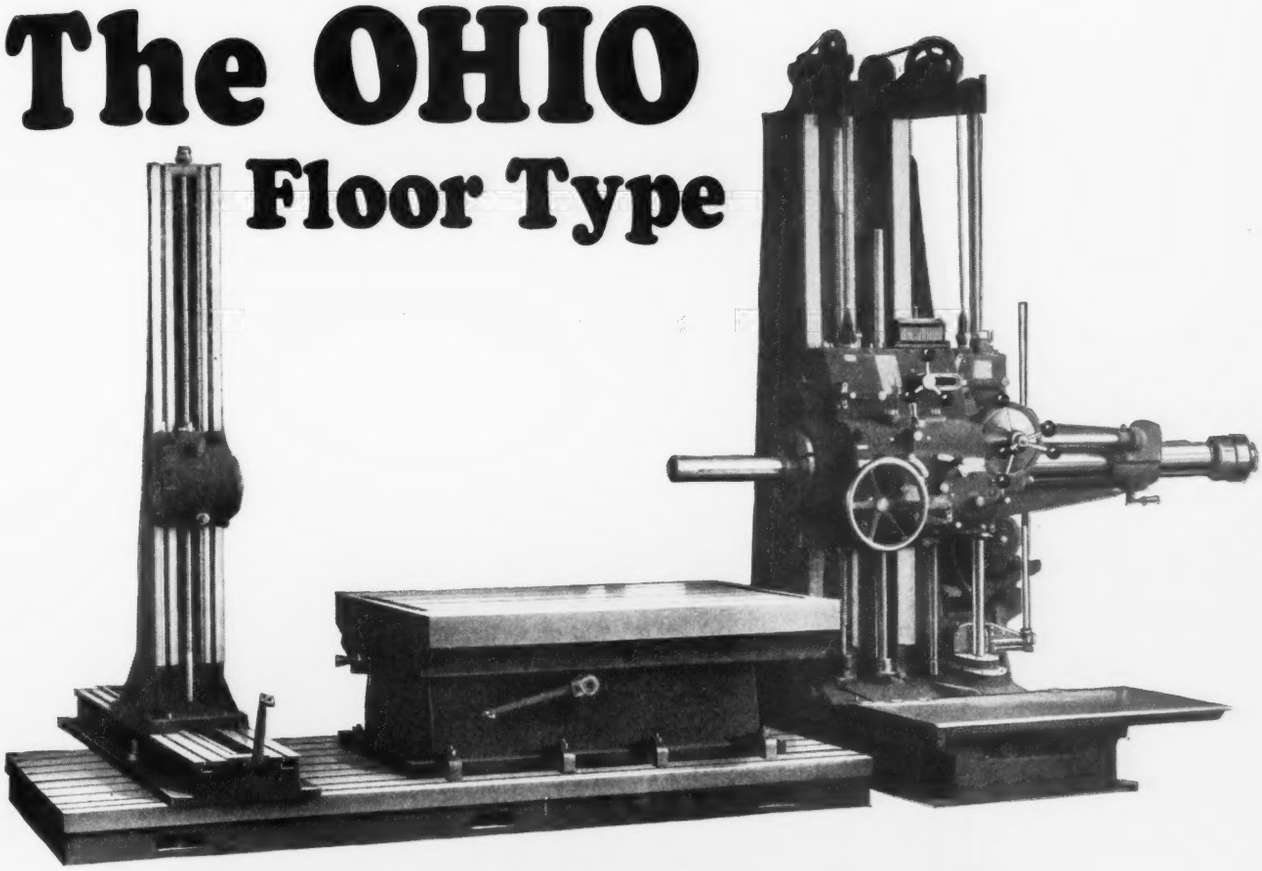
MANNING, MAXWELL & MOORE, INC., 100 E. 42nd St., New York City, has appointed the Smith, Booth, Usher Co., 228 Central Ave., Los Angeles, Calif., representative for Southern California covering the sale of Putnam machine tools manufactured at the Putnam Machine Works, Fitchburg, Mass. This line consists of heavy machine tools for railroad shops and general manufacturing purposes, including heavy production tools for automobile manufacturers, and machinery for steel and sheet mill plants.

STANLEY ELECTRIC TOOL CO., New Britain, Conn., announces that the company has acquired and added to its line of portable electric tools the Stanley-Crowe safety saws. This line of portable electric saws has been used for years by contractors and builders, and in all classes of woodworking industries. Safety in the operation of these saws is a feature especially emphasized. During the fourteen years of their manufacture, the makers have never hear of a single accident being caused by them.

MODERN TOOL WORKS DIVISION of CONSOLIDATED MACHINE TOOL CORPORATION OF AMERICA, Rochester, N. Y., has appointed George H. Diers, 2514 McMicken Ave., Cincinnati, Ohio, sales representative in the Cincinnati territory for the complete line of tools made by this company, including die-heads and chasers, chucks and collets, stud setters, milling cutters, and threading machines. The company is now represented in the Indianapolis territory by the Thompson Tool & Supply Co., Odd Fellows Building, Indianapolis, Ind.

REEVES PULLEY CO., Columbus, Ind., has opened its own sales and service branch office in Cleveland, Ohio, in the new Euclid-Windsor Building, 5005 Euclid Ave. A complete stock of Reeves variable-speed transmissions, as well as replacement and accessory parts, will be carried at the Cleveland branch. D. C. Batterson and J. H. Gepfert will be in charge of the new office. Mr. Batterson has had exclusive charge of the Reeves Pulley Co. in the Minneapolis territory for over three years. Mr. Gepfert has been associated with the company for a number of years in the Cleveland territory.

The OHIO
Floor Type



Horizontal Boring, Drilling and Milling Machines

The Ohio floor type Horizontal Boring, Drilling and Milling Machine has an abundance of power and strength to drive high speed tool steels to capacity limits. Convenience of control has been provided with a sensitiveness rarely found in a machine so powerful. This floor type machine is built with 4″, 4½″ and 5″ spindle diameters, with vertical traverse up to 7′0″ and horizontal traverse of post on runway to meet requirements. Bed plates, bar supports and other accessories to suit the work.

Ohio Horizontal Boring, Drilling and Milling Machines are also built in all other standard types and sizes, meeting every requirement for high grade machine tools of this class.

TABLE TYPE MACHINES

Built with 4″, 4½″ and 5″ spindle diameters with dimensions, specifications and complete line of attachments to meet the requirements of the modern shop.

PLANER TABLE TYPE MACHINES

Built with 4″, 4½″ and 5″ spindle diameters with tables, beds and dimensions arranged to suit the job.

COMBINATION FLOOR AND TABLE TYPE MACHINES

Built with 4″, 4½″ and 5″ spindle diameters consisting of standard floor type machine, equipped with table type bed, saddle, bar support either hand or power operated, giving practically all the advantages of the table type machine, and with the table unit removed the great range of the floor type machine is made available.

OHIO MACHINE TOOL COMPANY, KENTON, OHIO

General Distributors

JOSEPH T. RYERSON & SON, INC.

Chicago, Jersey City, Boston, Buffalo, Philadelphia, Cleveland, Detroit, Cincinnati, Milwaukee, Minneapolis, St. Louis, Tulsa, Kansas City, Denver. *Representation in:* New York, Syracuse, Pittsburgh, Richmond, Grand Rapids Duluth, Houston, Dallas, Los Angeles, San Francisco.

COMING EVENTS

APRIL 3-5—Twenty-fifth annual convention of the National Supply and Machinery Distributors' Association to be held at Hotel Peabody, Memphis, Tenn., in conjunction with the meetings of the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association. George A. Fernley, secretary-treasurer, 505 Arch St., Philadelphia, Pa.

APRIL 5-9—Fiftieth Anniversary Celebration of the American Society of Mechanical Engineers in New York and Washington, D. C. For further information address Calvin W. Rice, secretary, 29 W. 39th St., New York City.

APRIL 7-12—Annual convention and exposition of the American Oil Burner Association at the Hotel Stevens, Chicago, Ill. Executive secretary, Harry F. Tapp, 342 Madison Ave., New York City.

APRIL 8-9—Aeronautic Meeting of the Society of Automotive Engineers at Detroit, Mich. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

APRIL 16-17—Thirty-second annual convention of the National Metal Trades Association at the Hotel Astor, New York City. J. E. Nyhan, national secretary, Peoples Gas Building, Chicago, Ill.

MAY 1-3—Annual meeting of the American Gear Manufacturers' Association to be held at the Hotel Gibson, Cincinnati, O. T. W. Owen, secretary, American Gear Manufacturers' Association, 3608 Euclid Ave., Cleveland, Ohio.

MAY 12-16—Convention and exhibition of the American Foundrymen's Association to be held in the Public Auditorium, Cleveland, Ohio. C. E. Hoyt, manager of exhibits, 222 W. Adams St., Chicago, Ill.

MAY 14—Meeting of the Steel Founders' Society of America at the Hotel Hollenden, Cleveland, O. Managing director, G. P. Rogers, 932 Graybar Bldg., New York City.

MAY 19-21—Fifth National Aeronautic Meeting, sponsored by the American Society of Mechanical Engineers, to be held at Dayton, Ohio. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

MAY 21-23—National Foreign Trade Convention at Los Angeles, Cal. Secretary, O. K. Davis, National Foreign Trade Council, India House, New York City.

JUNE 6-7—Annual convention of the National Association of Foremen to be held in the Civic Auditorium and the Chamber of Commerce Building, Toledo, Ohio. Harry J. Baumker, convention secretary, 316 Tenth St., Toledo, Ohio.

JUNE 9-12—Semi-annual meeting of the American Society of Mechanical Engineers at Hotel Book-Cadillac, Detroit, Mich. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JUNE 12-14—Third national meeting of the Oil and Gas Power Division of the American Society of Mechanical Engineers to be held at Pennsylvania State College, State College, Pa. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JUNE 18-25—Annual meeting of the Mechanical Division, American Railway Association, in the new auditorium at Atlantic City, N. J. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

JUNE 18-25—Exposition of railway supplies and equipment to be held under the auspices of the Railway Supply Manufacturers' Association at Atlantic City, N. J. J. D. Conway, secretary-treasurer, 1841 Oliver Building, Pittsburgh, Pa.

JUNE 23-27—Annual meeting of the American Society for Testing Materials at Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary-treasurer, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.

JUNE 26-27—Semi-annual convention of the Steel Founders' Society of America at White Sulphur Springs, W. Va. Headquarters, Greenbrier Hotel. Managing director, G. P. Rogers, 932 Graybar Bldg., New York City.

AUGUST 24-29—Third International Congress of Applied Mechanics to be held at the Royal Technical Institute, Stockholm, Sweden. Further information may be obtained by addressing the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

SEPTEMBER 22-26—Annual convention and exposition of the American Society for Steel Treating in Chicago, Ill. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

DECEMBER 1-6—Ninth National Exposition of Power and Mechanical Engineering in the Grand Central Palace, New York City.

DECEMBER 1-6—Fifty-first annual meeting of the American Society of Mechanical Engineers in the Engineering Societies Building, New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

NEW BOOKS AND PUBLICATIONS

TRADE STANDARDS ADOPTED BY THE COMPRESSED AIR SOCIETY. 47 pages, 8½ by 11 inches. Published by the Compressed Air Society, 90 West St., New York City. Price, 50 cents.

THE WORKMEN'S COMPENSATION PROBLEM IN NEW YORK STATE. 375 pages, 6 by 9 inches. Published by the National Industrial Conference Board, Inc., 247 Park Ave., New York City. Price, $3.50.

ACID RESISTING COVER ENAMELS FOR SHEET IRON. By Andrew I. Andrews. 46 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 201 of the Engineering Experiment Station. Price, 25 cents.

THERMAL PROPERTIES OF PETROLEUM PRODUCTS. 48 pages, 7 by 10 inches. Published by the United States Department of Commerce, Washington, D. C., as Miscellaneous Publication No. 97 of the Bureau of Standards.

EQUIPMENT FOR GAS-LIQUID REACTIONS. By Donald B. Keyes. 14 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Circular No. 19 of the Engineering Experiment Station. Price, 10 cents.

METALLOGRAPHIC POLISHING. By S. Epstein and John P. Buckley. 12 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Research Paper No. 117 of the Bureau of Standards.

TURNING WITH SHALLOW CUTS AT HIGH SPEEDS. By H. J. French and T. G. Digges. 70 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Research Paper No. 120 of the Bureau of Standards. Price, 30 cents.

OBSERVATIONS ON THE IRON-NITROGEN SYSTEM. By S. Epstein, H. C. Cross, E. C. Groesbeck and I. J. Wymore. 1027 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Research Paper No. 126 of the Bureau of Standards. Price, 20 cents.

INVESTIGATION OF ENDURANCE OF BOND STRENGTH OF VARIOUS CLAYS IN MOLDING SAND. By Carl H. Casberg and William H. Spencer. 28 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 200 of the Engineering Experiment Station. Price, 15 cents.

MECHANICAL WORLD ELECTRICAL POCKET BOOK (1930). 326 pages, 4 by 6 inches. Published by Emmott & Co., Ltd., 65 King St., Manchester, England. Price, 1/6, net.

This is the twenty-third edition of a little handbook containing a collection of electrical engineering notes, rules, tables, and data. Some of the new matter found in the present edition relates to heavy electrical engineering. All the former sections have been retained and brought up to date, and much of the matter has been rewritten and expanded.

LECTURES ON STEEL AND ITS TREATMENT. By John F. Keller. 329 pages, 6 by 9 inches. Published by the American Society for Steel Treating, 7016 Euclid Ave., Cleveland, Ohio. Price, $3.50.

This is the second revised edition of a book containing the substance of a series of sixteen lectures on steel and its treatment, which are the result of many years of intensive study of the properties of iron and steel by the author. This edition includes some new material that the author has been using in his lectures during the last two years. The lectures treat of the following subjects: Melting the Steel and Working the Ingot; Mechanical Working of Iron and Steel; The Iron-carbon Diagram, Annealing and Cast Iron; Determination of Critical Points and Physical Testing; Hardening, Quenching, Tempering and Carburizing; Warping, Cracking and Shrinking of Steel; Alloy Steel, Cast Steel and Welding.

THE SUCCESSFUL CONTROL OF PROFITS. By Walter Rautenstrauch. 239 pages, 5 1/4 by 8 inches. Published by the B. C. Forbes Publishing Co., 120 Fifth Ave., New York City. Price, $3.

In the present day of keen competition when costs are being scrutinized and all factors affecting profits are being carefully analyzed, this book dealing with the control of profits will be of timely interest. The author shows how every phase of a business may be subjected to searching analysis. He deals extensively with costs and overhead; he shows that many of the characteristics of an enterprise may be learned from a study of the relations between fixed and variable costs and the selling level of a manufactured article. He points out what a balance sheet and a profit and loss statement may be made to reveal, and he outlines a practical budget system. Many charts and diagrams are used to illustrate the points made.

HOW TO WRITE. By John M. Clapp and Homer H. Nugent. 555 pages, 6 by 8 1/2 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $5.

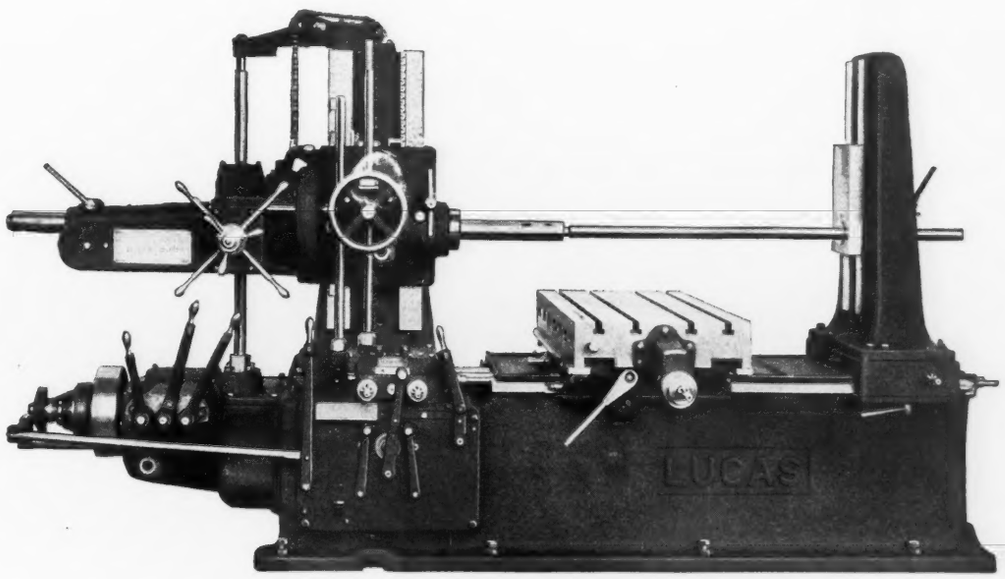
While a great deal has been written on this subject, it is believed that the present work differs in its viewpoint from previous books. The authors have aimed to meet adult needs rather than to provide a text for school-room use, and hence rules of grammar and rhetoric are not included. They have attempted to aid men and women who wish to develop their abilities to put their thoughts into written form so as to accomplish specific purposes with less effort and with greater effectiveness, the emphasis being placed on the purpose for which the writing is done. The book provides a systematic course in writing from the simplest and easiest types up to the more complex forms. It is divided into seven parts classified as follows: Getting the Right Point of View; The Writing You Do for Yourself—the Problem of Accurate Statements; Writing to Friends—the Problem of Suggestion; Writing in Business and Professional Life; Addressing the Public; Writing for Fun; Language—the Medium of Communication.

One of our Recent Unsolicited Testimonial Letters—

"We are very much pleased with our LUCAS Horizontal Boring Machine and want to compliment you on the splendid finish, as well as the careful attention to detail throughout the job.

It has always been our policy to purchase the best machines we could find and we feel that again our choice has been a wise one."

Furthermore, we lived up to our delivery promise, as usual



No. 41 "Precision" Horizontal Boring Machine with 3" spindle.
We also make the No. 42 Machine with 4" spindle and No. 43 size with 5" spindle.
Send for descriptive circulars.

THE LUCAS MACHINE TOOL CO., Cleveland, Ohio

FOREIGN AGENTS: Allied Machinery Co., Barcelona, Zurich. V. Lowener, Copenhagen, Oslo, Stockholm. R. S. Stokvis & Zonen, Paris and Rotterdam. Andrews & George Co., Tokyo. Ing. M. Kocian & G. Nedela, Prague. Emanuele Mascherpa, Milan, Italy.

NEW CATALOGUES AND CIRCULARS

BALL BEARINGS. Fafnir Bearing Co., New Britain, Conn. Catalogue containing data sheets giving information on Fafnir ball bearings for aircraft.

CONSTRUCTION ENGINEERING. Morton C. Tuttle Co., Boston, Mass. Circular illustrating some of the industrial structures erected by this company.

DRIVES FOR SCREW CONVEYORS. Link-Belt Co., 300 W. Pershing Road, Chicago, Ill. Leaflet illustrating Caldwell standardized drives for screw conveyors.

LIGHTING EQUIPMENT. General Electric Vapor Lamp Co., Hoboken, N. J. Circular illustrating the illumination of factories by mercury vapor lamps.

TRANSMISSION EQUIPMENT. Reeves Pulley Co., Columbus, Ind. Circular illustrating different types and applications of Reeves variable-speed transmission equipment.

KNIFE GRINDERS AND SAW SHARPENERS. Samuel C. Rogers & Co., 191 Dutton Ave., Buffalo, N. Y. Illustrated price list, covering Rogers knife grinders and saw sharpeners.

MELTING TANKS. H. O. Swoboda, Inc., 3400 Forbes St., Pittsburgh, Pa. Bulletin 170, descriptive of the Falcon electrically heated compound melting tank for melting asphaltum and similar compounds.

AVIATION ENGINES. Light Mfg. & Foundry Co., Pottstown, Pa. Catalogue covering the features of the "Brownback Tiger" aviation engine. The company is also issuing a reduction in list price announcement.

ELECTRIC CONTROL APPARATUS. Allen-Bradley Co., 499 Clinton St., Milwaukee, Wis. Circular illustrating Allen-Bradley automatic starters for alternating-current motors, designed to protect man, motor, and machine.

CORK PRODUCTS. National Cork Products, Inc., 357 Ogden St., Newark, N. J. Circular entitled "Insurance Against Leaks," listing the uses of Nacotex, a new gasket compound for preventing leaks in unions of all kinds.

DIE-HOLDING STANDS. Davenport Locomotive & Mfg. Corporation, Davenport, Iowa. Circular outlining the advantages of Davenport universal die-holding stands, which are so designed as to effect large savings in space.

MILLING CUTTERS. Brown & Sharpe Mfg. Co., Providence, R. I. First of a series of cutter bulletins discussing the cost of time lost in removing and replacing cutters, and how this is reduced by the use of B. & S. cutters.

EMERY-WHEEL DRESSERS. Desmond-Stephan Mfg. Co., Urbana, Ohio. Circular illustrating and describing Desmond - Rearwin emery-wheel dressers, which have cutters of special spiral design that are said to be self-sharpening.

DROP-HAMMERS. Erie Foundry Co., Erie, Pa. Bulletin 230, illustrating and describing Erie Type G steam drop-hammers. In addition to the description of these machines, the bulletin contains instructions for erection and maintenance.

ELECTRIC EQUIPMENT. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Leaflet 20451, descriptive of the type FO-22 weatherproof oil circuit-breaker for outdoor installations or indoor service where there is considerable dust or moisture.

TUNGSTEN-CARBIDE TOOLS. Firth-Sterling Steel Co., McKeesport, Pa. Booklet on Firthite tungsten-carbide tools, describing the composition of Firthite, its characteristics, and applications. Instructions for using and grinding Firthite tools are included.

ROLLER BEARINGS. American Roller Bearing Co., Pittsburgh, Pa. Catalogue containing installation sketches, load-capacity tables, and photographs of roller-bearing equipped machinery. The bearings shown are intended particularly for heavy-duty service.

ELECTRIC CONTROL APPARATUS. Cutler-Hammer, Inc., 1204 St. Paul Ave., Milwaukee, Wis. Leaflet entitled "C-H Protects Small Motors," announcing a new free tripping thermal overload switch for fractional horsepower motors known as Bulletin 9101.

GRINDING MACHINES. Norton Co., Worcester, Mass. Catalogue descriptive of Norton universal tool and cutter grinding machines, which are made in both belt- and motor-driven types. The equipment and attachments supplied with these machines are also illustrated.

MATERIAL HANDLING AND CONVEYING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Circular illustrating the application of the Cleveland tramrail system for handling bulky and unwieldy loads.

HEAT-TREATING FURNACES. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Bulletin 950, descriptive of the Homo method of nitriding steel. The Homo nitriding furnace is described in detail, including methods of control. Typical installations of these furnaces are shown.

MILLING MACHINES. Kearney & Trecker Corporation, Milwaukee, Wis. Circular illustrating and describing in detail the new bridge type vertical Mil-Waukee-Mil, which is so constructed that it serves as a universal machine adapted for a wide range of heavy-duty vertical milling work.

PRECISION LATHES. South Bend Lathe Works, 772 E. Madison St., South Bend, Ind. South Bend Handbook No. 44 for the mechanic, containing data on the 1930 new model South Bend precision lathes. The illustrations show the wide range of jobs for which these lathes are adapted.

STELLITE. Haynes Stellite Co., Kokomo, Ind. Publication entitled "Properties of Haynes Stellite," containing a general description of the Haynes Stellite alloys, including physical properties, chemical properties, and structure, and an outline of their uses and methods of application.

ALUMINUM. Aluminum Co. of America, Pittsburgh, Pa. Pamphlet entitled "The Riveting of Aluminum and Its Alloys," discussing the design of riveted joints, methods employed in riveting, riveting machines and tools, and special riveting developments in the aircraft industry.

AUTOMATIC BAR MACHINES. Budd-Ranney Engineering Co., Columbus, Ohio. Circular illustrating and describing B & R automatic bar machines, which are designed primarily for one class of production, that of work from bar stock where the operations required include drilling, side or end forming, and cutting off.

FURNACES. Hevi Duty Electric Co., Milwaukee, Wis. Bulletin 230, devoted to electric conveyor furnaces of the floating belt type for conveying parts to be heat-treated through the furnace. Catalogue 30, containing detailed descriptions and specification of a complete line of electric furnaces and hot plates for laboratory use.

TRANSMISSION EQUIPMENT. Diamond Chain & Mfg. Co., 409 Kentucky Ave., Indianapolis, Ind. Booklet containing data on sprockets for roller chain drives. Complete mechanical specifications are shown for single- and multiple-strand chains for drives rated up to 672 horsepower. Prices are given for each type of sprocket.

WELDING RODS. Fusion Welding Corporation, 103rd St. and Torrence Ave., Chicago, Ill. Form A-43, listing the company's complete line of "Weldite" welding rods, which includes forty distinct types of rod adapted to cover every phase of welding. General information, such as standard rod sizes and lengths, packing, and other details, is also included.

INDICATING AND RECORDING INSTRUMENTS. Brown Instrument Co., 4485 Wayne Ave., Philadelphia, Pa. Catalogue 7501, containing data on Brown indicating and recording remote type instruments for measuring pressures, liquid levels, and flows, and for indicating positions of controls. Sectional views and wiring diagrams supplement the descriptive material.

TAPS AND DIES. National Acme Co., Cleveland, Ohio. Catalogue on "Namco" opening dies and collapsing taps, comprising nine separate bulletins, each of which presents the salient features of one line of "Namco" taps or dies. These bulletins contain a detailed description of the outstanding features and operation of these dies and taps, and list regular stock sizes.

HEAT-TREATING EQUIPMENT. Wilson-Maeulen Co., Inc., 382 Concord Ave., New York City. Catalogue L3, covering this company's line of recording, indicating, and controlling pyrometers for regulating industrial types of oil, gas, and electric furnaces. Catalogue entitled, "An Inspection Tour of Industrial Plants," showing a variety of installations of Wilson-Maeulen automatic temperature controllers.

TURRET LATHES. Warner & Swasey Co., Cleveland, Ohio. Bulletin entitled "Profits from Replacement," illustrating the tooling and methods employed in machining clutch throwout collars on Warner & Swasey turret lathes, and giving actual figures showing the increase in production effected, as compared with previous methods. Other examples of savings accomplished in handling jobs on Warner & Swasey turret lathes are described.

SMALL TOOLS. Scully-Jones & Co., 1901-9 S. Rockwell St., Chicago, Ill. Small tool catalogue 37, showing a number of additions to the line of "Wear-Ever" production tools made by this concern, including the "Magic" type quick-change chuck and collets, standard B & S milling machine arbors, hardened arbor sleeves, shell end-mill arbors, adapters, milling machine collets, etc. The catalogue also contains the latest commercial standards as adopted by tap and die manufacturers.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Bulletins GEA-19F, 474-A, 904C, 945A, 1045A, 1196, 1231, and 1232, treating, respectively, of alternating-current enclosed magnetic switches; truck type switching equipment; single-stage centrifugal air compressors for cupola blowing; Types CK_1 and CK_2 air circuit-breakers; control and instrument switches; Type CN-1 air circuit-breakers; induction motors; and electric equipment for handling heavy material.

TRANSMISSION EQUIPMENT. Morse Chain Co., Ithaca, N. Y. Bulletin 38, containing data on Morse silent chain drives. The book gives information on designing, installing, and maintaining these drives, and a complete set of tables is included covering pitches, horsepower ratings, and dimensions. Prices are given both for the regular Morse line and for special chains, sprockets, etc. The book also shows practical applications of Morse chain speed reducers and flexible couplings on everyday power transmission jobs.